FREEWHT

PLC application for seasoning cycle cells

TABLE OF CONTENTS

1 HOW TO USE THIS MANUAL

This manual is designed to permit quick, easy reference with the following features:

References

References column:

A column to the left of the text contains references to subjects discussed in the text to help you locate the information you need quickly and easily.

Cross references

Cross references:

All words written in italics are referenced in the subject index to help you find the page containing details on this subject; supposing you read the following text:

"*compressor*, *evaporator fans* and *defrost* output are deactivated and alarm manual rearm is required"

The italics mean that you will find a reference to the page on the topic of compressor / evaporator fans / defrost listed under the item compressor / evaporator fans / compressor (respectively).

If you are consulting the manual on-line (using a computer), words which appear in italics are hyperlinks: just click on a word in italics with the mouse to go directly to the part of the manual that discusses this topic.

Icons for emphasis

Some segments of text are marked by icons appearing in the references column with the meanings specified below:

Warning!: information which is essential for preventing negative consequences for the system or a hazard to personnel, instruments, data, etc., and which users must read with care.

Take note: information on the topic under discussion which the user ought to keep in mind.

Tip: a recommendation which may help the user to understand and make use of the information supplied on the topic under discussion.

2   INTRODUCTION

2.1   General description

FREEWHT is an application targeting the FREE Evolution programmable controller family which can control functions in both conventional and ventilated cold rooms, including combined temperature and humidity control.

It is suited to the control of commercial and industrial cold cells and, thanks to the wide number of outputs available, provides control of all associated functions, including lights, alarms, fans, humidification / dehumidification, and heating.

The curing/ageing/storing cycle consists of 1 program with 8 climate profiles; completely configurable by the user, the combined control of temperature and relative humidity as well as defrosting makes FREEWHT on FREE Evolution the best electronic solution for curing and keeping all food and consumable products.

The graphic interface features a backlit LCD display.

Menus are user-friendly and parameters can be easily viewed thanks to the large surface area of the display itself.

Applications:

- butchers;
- sausage and salami production;
- delicatessens;
- cheese production;
- pasta production;
- vegetable production;
- food storage cells (fruit, vegetables, meat);
- abattoirs;
- dryers for wood, skins, paper, marble.

3   USER INTERFACE

The front panel of the device functions as user interface and is used to perform all operations relating to the device.

3.1   Keys

FREE Evolution programmable controller has 5 keys. Each key is associated with:

- a direct action, simply bound to the key press;

- a function associated to a long key press (press and hold for about 3 seconds).

The action/function associated to a key depends on the currently displayed menu, according to the following table.

Key	Single press		Edit mode	Long key press	
UP	Select previous element		Decrement value of selected digit	-	
DOWN	Select next element		Increment value of selected digit	Default behavior	-
				Password entry menu	Log out
LEFT/ESC	Default behavior	Select previous element	Select next digit / Exit without saving	Back to previous page	
	States / Parameters menu	Back to previous page			
	Thermal profiles program control panel	Reset thermal profiles program			
RIGHT	Default behavior	Select next element	Select previous digit	Default behavior	-
	States / Parameters menu	-		Main view	Open main menu
	Thermal profiles program control panel	Start/Stop thermal profiles program			
ENTER	Enter edit mode / Enter sub-menu / Trigger action associated to a button		Exit and save	-	

3.2   LED

The FREE Evolution programmable controller has three LEDs, two of which are use by the application with the meaning shown in the following table.

LED	Meaning	Steady ON	Blinking
Red	Global alarm status	At least one alarm is active	No alarm active, but at least one manual rearm alarm is waiting for reset
Yellow	-	-	-
Green	ON/OFF state	Application state is ON	-

3.3   Main view

When the device is switched on, it displays the main view, from which you can monitor the application state, issue a few commands, and enter the application menus.

Overview of user interface's main view
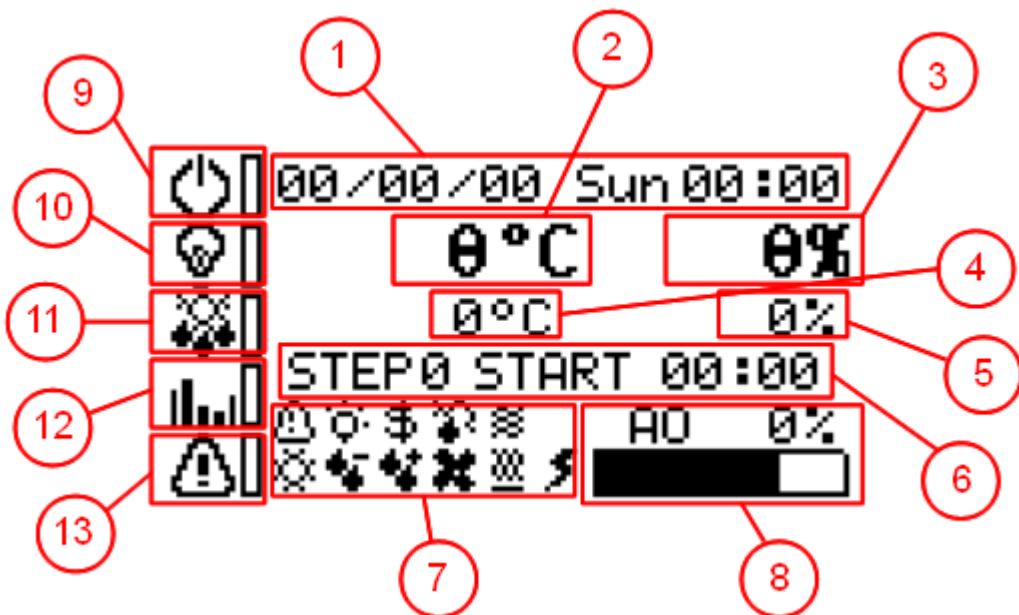
Main view's elements

Main view's elements are listed below:

1. system date and time;

2. feedback value read by the temperature probe, if available and properly configured;

3. feedback value read by the humidity probe, if available and properly configured;

4. temperature setpoint, if thermoregulation is enabled;

5. humidity setpoint, if relative humidity regulation is enabled;

6. thermal profiles program status, if enabled;

7. application status (see below, for details);

8. analog output value, if configured;

9. button to enter stand-by mode;

10. button to switch on/off light;

11. button to issue a manual defrost request;

12. button to open thermal profiles program control panel (Start/Stop/Reset), if enabled;

13. button to show the list of all currently active alarms.

3.3.1 Application status

The main view depicts the application status, including the state of the controller output and the activation of some regulation functions, with a set of icons.

State icons overview
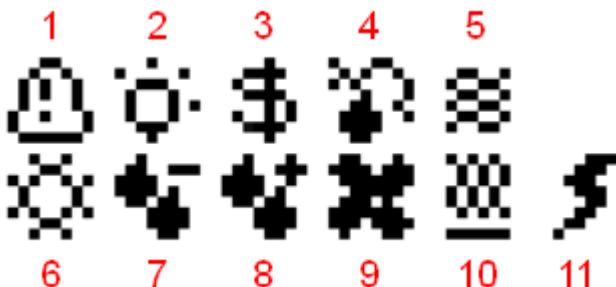
State icons meaning

The meaning of each state icon is discussed in the following table.

Ref.	Description	Steady ON	Blinking
1	Global alarm status	At least one alarm is active	No alarm active, but at least one manual rearm alarm is waiting for reset
2	Light relay	Light relay is active (unless power-on exclusion is active, too; see **1014: ODO** parameter)	-
3	Economy mode (reduced setpoint)	Economy mode is active	-
4	Defrost state	Defrost is active	Defrost request discarded
5	Ventilation fans relay	Ventilation fans relay is active (unless power-on exclusion is active, too; see **1014: ODO** parameter)	-
6	Compressor relay	Compressor relay is active (unless power-on exclusion is active, too; see **1014: ODO** parameter)	Compressor activation request pending, but compressor relay is not active, due to a one or more safety times)
7	Dehumidifier relay	Dehumidifier relay is active (unless power-on exclusion is active, too; see **1014: ODO** parameter)	-
8	Humidifier relay	Humidifier relay is active (unless power-on exclusion is active, too; see **1014: ODO** parameter)	-
9	Evaporator fans relay	Evaporator fans relay is active (unless power-on exclusion is active, too; see **1014: ODO** parameter)	-
10	Heater relay	Heater relay is active (unless power-on exclusion is active, too; see **1014: ODO** parameter)	-
11	Electric defrost relay	Electric defrost relay is active (unless power-on exclusion is active, too; see **1014: ODO** parameter)	-

3.3.2   Changing setpoint

Changing setpoint from the main view

You can change both temperature and humidity setpoint, to be used in regulation, directly from the main view.

Just select the right element in the main view and enter edit mode.

3.4   Main menu

To enter the main menu just press and hold the RIGHT key in the main view.

The main menu gives access to many sub-menus and, after successful authentication, to the parameter menus.

Main menu overview
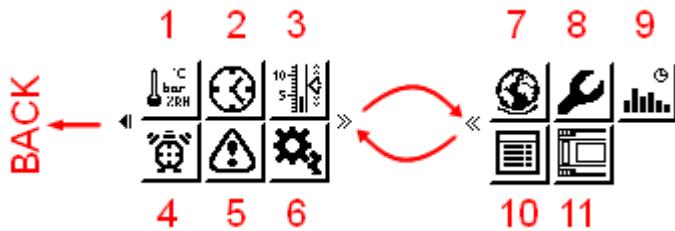
Main menu elements

Main menu elements, giving access to sub-menus, are listed in the following table.

Ref.	Icon	Description	Password
1		Probes menu	No
2		Clock menu	No
3		Setpoint menu	No
4		Automatic defrost time events	No
5		Active alarms menu	No
6		Functions menu	No
7		Language selection menu	No
8		Parameters menu	Either user or installer access rights
9		Thermal profiles program	No
10		States menu	No
11		BIOS parameters menu	Installer access rights

3.5 Active alarms menu

Active alarms menu shows the whole set of currently active alarms and those waiting for manual reset. When more than one alarm is active, you have to scroll the list with UP and DOWN keys.

Alarm reset command

From the active alarms menu you can issue a command to reset alarms, by pressing the reset button.

3.6 Language selection menu

All menus are available in both the English and the Italian language.

Language selection | The user interface language can be changed by selecting the desired language in the language selection menu.

If the selected language differs from the currently active language, the FREE Evolution programmable controller will reboot: after restarting, the selected language would be set.

3.7 Parameters menu

Password entry | To access parameters/BIOS parameters menu, access rights have to be granted by successfully log in – that is, by entering a password when prompted by the user interface: if the password matches the value of either **1122: PA1** or **1123: PA2** parameter, User or Installer access rights are granted to the operator, respectively.

Log out | Access rights remain until either the main menu is closed (back to main view) or an explicit log out command is issued by pressing and holding the DOWN key, in the password menu.

User menu | Parameters menu is displayed differently for different access rights: the user menu
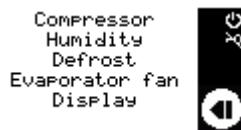
Installer menu | gives access to a sub-set of the elements available in the installer menu.

Sub-menu contents also depends upon access rights.

4   I/O CONFIGURATION

⚠ **Please refer to FREE Evolution Installation Manual, for important information about electric connections between the FREE Evolution programmable controller and devices connected to its I/O.**

Device configuration is determined by the values of I/O configuration parameters available in the configuration menu.

4.1   Analog Input configuration

Probes The application uses four probes, whose meaning to the application is discussed in the following table.

Probe	Meaning
Pb1	Cell temperature (*thermoregulation*)
Pb2	Evaporator temperature (*defrost*)
Pb3	Cell relative humidity (*relative humidity regulation*)
Pb4	*Cut-off regulator* feedback

Probe association to analog input Probes **Pb1** … **Pb4** are associated to FREE Evolution controller's analog inputs by means of **1180: H41** … **1183: H44** parameters.

The same analog input can be assigned to more than one logical probe. For example, it is possible to use the same feedback for both *thermoregulation* (**Pb1**) and the *cut-off regulator* regulating the *analog output* (**Pb4**).

The table below lists default values for parameters **1180: H41** … **1183: H44.**

Parameter	Default value
1180: H41	Analog input 1
1180: H42	Analog input 2
1180: H43	Analog input 3
1180: H44	Analog input 4

You can also disable one or more probes by setting the related parameter to Disabled: in this case, the corresponding regulation function is inhibited.

Analog input physical configuration Physical characteristics (type – NTC/voltage/current –, start of scale, full scale, calibration) of FREE Evolution programmable controller's analog inputs are set by means of its BIOS parameters, discussed in FREE Evolution Installation Manual and available in the BIOS parameters menu accessed from the main menu.

4.2   Digital Input configuration

The application uses FREE Evolution programmable controller's first two digital inputs with the meaning determined by the parameters **1159: H11** e **1160: H12**.

Digital input configuration table The table below records the association between parameters and digital input configuration.

Parameter	Description	Range	Meaning	Default value
1159: H11	Digital input 1 (**DIL1**) configuration	-21…+21	See following tables	+4=NO: Door switch
1160: H12	Digital input 2 (**DIL2**) configuration	-21…+21	See following tables	+5=NO: External alarm

The meaning of single values of **1159: H11** e **1160: H12** parameters is reported in the following table.

Value	Description	Notes
0	Disabled	
±1	*Defrost* request	Toggle mode
±2	Economy mode (reduced setpoint)	
±4	Door switch	
±5	External alarm	

Value	Description	Notes
±7	Stand-by	
±11	*Pressure switch*	
±14	Light relay activation	
±15	*Ventilation fans* relay activation	
±18	Panic alarm	
±20	*Heating/Cooling mode* selection	
±21	Start/Stop *thermal profiles* program	Toggle mode

Digital input polarity

Digital input polarity is configured according to the following rules:

		Value	Description
+	NO	Positive	Active when contact is open (Normally Open)
-	NC	Negative	Active when contact is closed (Normally Closed)

Digital input priority

If both **1159: H11** and **1160: H12** are set to the same value, digital input 1 takes the priority over digital input 2 – that is, digital input 2 is ignored.

4.3   Digital output (relay) configuration

⚠️ **Please refer to FREE Evolution Installation Manual for the available number of relays and their capacity and for the meaning of the symbols found on labels supplied with the device.**

Digital output configuration

The following table explains the meaning the application assigns to FREE Evolution programmable controller's digital outputs and the parameters used to configure them.

Description	Meaning	Configuration	Default
Digital output 1 (**DO1**)	*Humidifier*	Fixed (not configurable)	-
Digital output 2 (**DO2**)	*Heater*	Fixed (not configurable)	-
Digital output 3 (**DO3**)	*Dehumidifie*r / Electric *defrost* relay	Configurable (parameter **H22**)	Dehumidifier
Digital output 4 (**DO4**)	*Compressor*	Fixed (not configurable)	-
Digital output 5 (**DO5**)	*Evaporator fans*	Fixed (not configurable)	-
Digital output 6 (**DO6**)	Disabled / Light / *Ventilation fans*	Configurable (parameter **1168: H26**)	Luce
Digital output 7 (**DO7**)	Disabled / Light / *Ventilation fans*	Configurable (parameter **1169: H27**)	Disabled

4.4   Analog output configuration

Application manages one analog output as the output of a widely-parametric *cut-off regulator*.

Analog output physical configuration

Physical characteristics (type - On-Off/voltage/current -, etx.) of FREE Evolution programmable controller's analog output are set by means of its BIOS parameters, discussed in FREE Evolution Installation Manual and available in the BIOS parameters menu accessed from the main menu.

4.5   Communication channels configuration

BIOS parameters menu, available in the application main menu, gives access also to configuration parameters of the communication channels available on the FREE Evolution programmable controller. See FREE Evolution Installation Manual for details.

5   COMPRESSOR

The compressor is controlled by one of the device's *digital output*. It will be switched on or off depending on:

- the temperature measured by *probe* **Pb1**;
- *thermoregulation* settings;
- *defrost*/dripping settings.

5.1   Compressor configuration

For information about connecting the compressor to the device, refer to FREE Evolution Installation Manual.

Compressor relay

The compressor is bound to relay **DO4**. Relay polarity is fixed.

5.2   Compressor operating conditions

The regulator is activated provided that:

- application state is ON;
- *alarm* **E1** is not active (cell temperature probe **Pb1** error);
- the time set in parameter **1014: ODO** has elapsed;
- a *defrost* cycle is not active (FREE mode excluded – see parameter **1028: DTY**).

The parameters of this regulator are:

- **SET1** setpoint, which can be chosen in a range defined by a minimum setpoint and a maximum setpoint (parameters **1004: LSE** e **1003: HSE**);
- differential (parameter **1002: DIF**).

Compressor regulation diagram

The diagram below indicates the compressor activation mode for cooling based on the **SET1** and **1002: DIF** > 0 parameter.
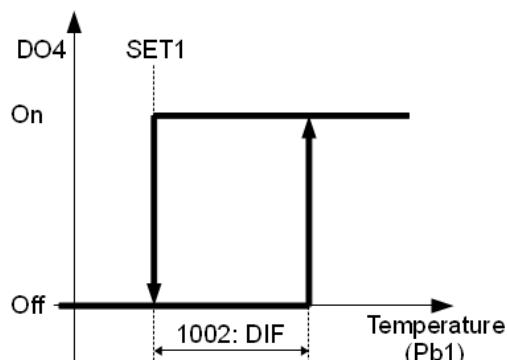
5.2.1   Compressor protection in the event of probe failure (duty cycle)

1009: ONT e 1010: OFT parameters

If the cold room probe **Pb1** fails (*alarm* **E1**), the output configured as compressor regulates in accordance with the times set in parameters **1009: ONT** and **1010: OFT**. The first time to consider is **1009: ONT**. If **1009: ONT** > 0, the protection programmed in parameters **1011: DON** / **1012: DOF** / **1013: DBI** must be respected (see *Compressor safety times*).

The table below lists the ways the compressor relay output can be managed:

1009: ONT	1010: OFT	DO4
0	0	Off
0	>0	Off
>0	0	On
>0	>0	Duty Cycle

Compressor duty cycle

If **1009: ONT** > 0 and **1010: OFT** > 0, the compressor regulator activates in operating cycle mode irrespective of the

values read by the probes (cold room probe failure) and of requests from other utilities (duty cycle mode).

If the cold room probe is working properly, the duty cycle mode does not start as it does not have priority over normal compressor regulation settings.

Compressor duty cycle diagram
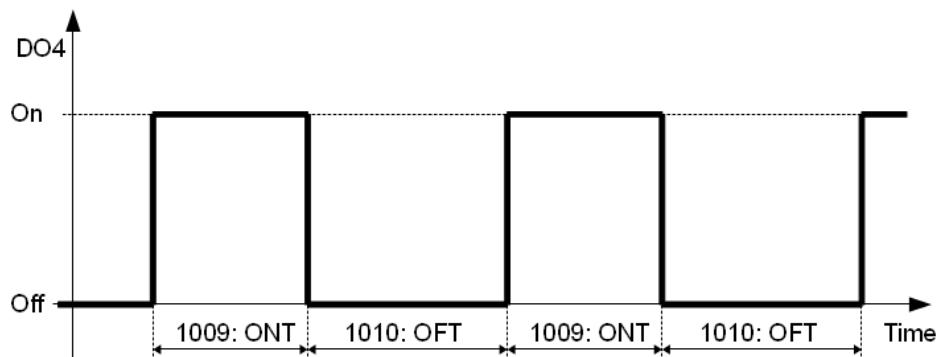
☞ You are reminded that parameter **1014: ODO** inhibits the activation of all outputs commanding a relay for its entire duration (compressor, defrost, fans, etc.).

5.2.2 Compressor safety times

Compressor on-off operations must respect the safety times that you can set using the special parameters as described below. The compressor *LED* will flash to indicate when an activate compressor request has been received but a safety protection exists.

Off-on timing

A safety time (compressor on-off safety time) regulated by the parameter **1012: DOF** must be respected between a switch-off and switch-on of the same compressor.

This waiting time also occurs when the controller is powered on.

On-on timing

A safety time (compressor on-on safety time) regulated by the parameter **1013: DBI** must be respected between one switch-on and the next.

Delay

The safety time set in parameter **1011: DON** must elapse between a start-up request and actual start-up.

Times set with parameters **1011: DON / 1012: DOF / 1013: DBI**, if active, are not accumulative but parallel.

Diagram of compressor safety times

Compressor protection diagram with parameters **1011: DON / 1012: DOF / 1013: DBI** configured.

IN	Input state for compressor regulator
OUT	Output state for compressor regulator
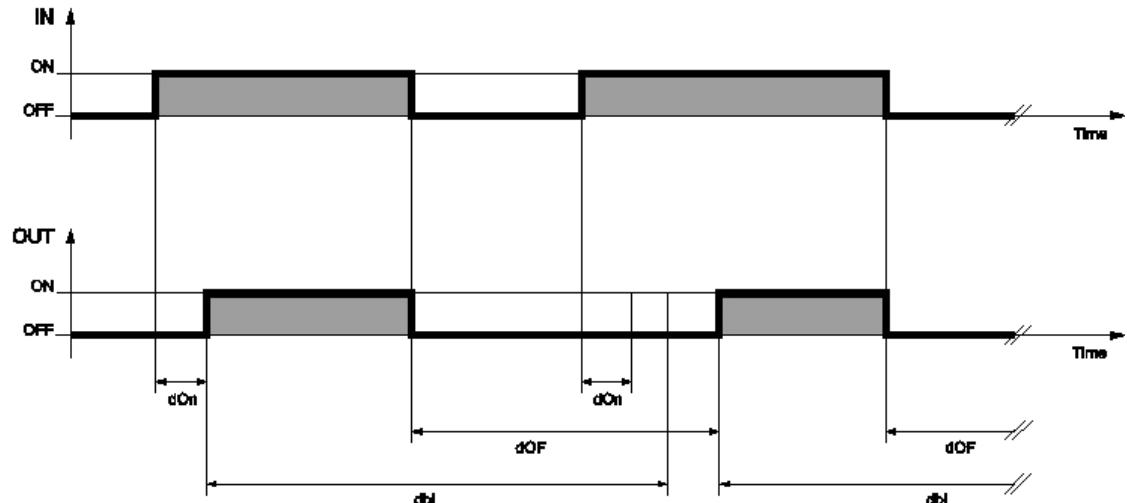
6   HEATING / COOLING

Thermoregulation *parameters* can be viewed and configured in the folders:

- *Compressor* menu (parameter **1002: DIF**);

- *Humidity* menu (parameter **1027: DB**);

- *Configuration* menu (parameter **1156: H07**, **1159: H11** e **1160: H12**).

Parameter **1156: H07** determines thermoregulation type and the set of parameters relevant to that process.

1156: H07	*Digital input*	Setpoint	*Relay*
Disabled	-	-	-
Neutral zone	-	**SET1**	Both **DO2** and **DO4**
Cooling only	-	**SET1**	**DO4**
Heating only	-	**SET2**	**DO2**
From *digital input*	Cooling	**SET1**	**DO4**
	Heating	**SET2**	**DO2**

6.1   Heating

Set thermoregulation type to **1156: H07** = Heating only.

Heating relay		Comments
ON	OFF	
Temperature ≤ **SET2** - **1027: DB**	Temperature > **SET2**	Differential = **1027: DB** always positive

Heating regulation diagram
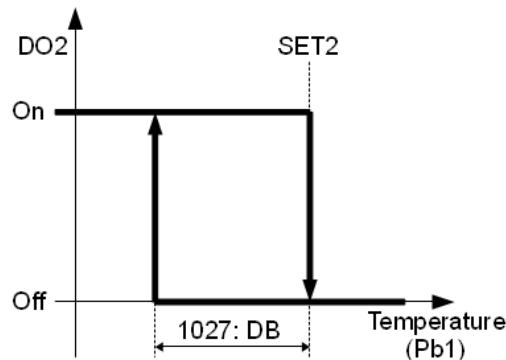
6.2   Cooling

Set thermoregulation type to **1156: H07** = Cooling only.

Compressor relay		Comments
ON	OFF	
Temperature ≥ **SET1** + **1002: DIF**	Temperature < **SET1**	Differential = **1002: DB** always positive

Cooling regulation diagram

DO4 SET1

On

Off

1002: DIF

Temperature (Pb1)
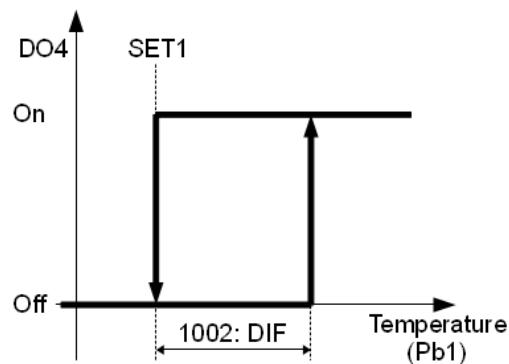
6.3 Neutral zone

Set thermoregulation type to **1156: H07** = Neutral zone.

Thermoregulation diagram (in neutral zone)

SET1

On

DO2

Off

1027: DB

Temperature (Pb1)

On

DO4

Off

1002: DIF

Temperature (Pb1)
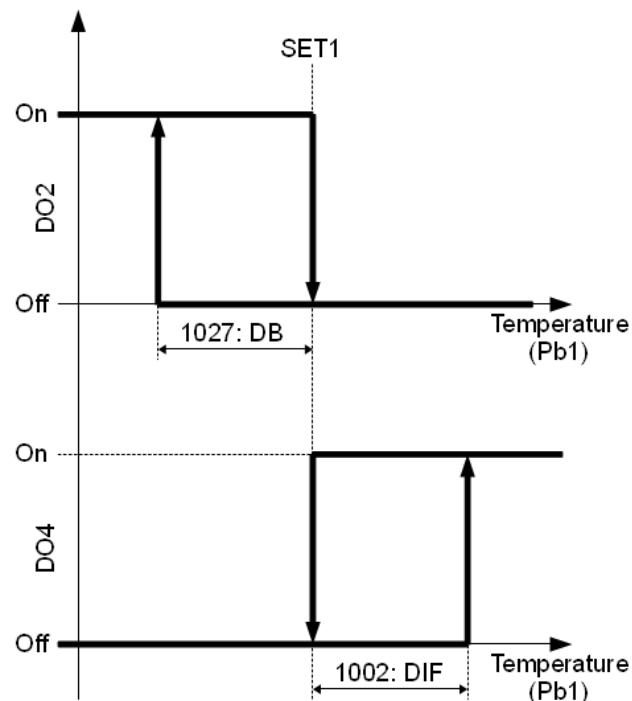
6.4 Heating/Cooling

Set thermoregulation type to **1156: H07** = From digital input. Set a *digital input* as heating/cooling: **1159: H11** / **1160: H12** = Heat/Cool (beware of polarity NO/NC).

☞ These settings do not allow thermoregulation in neutral zone.

Diagram of thermoregulation with digital input mode selection

Digital input = COOL   Digital input = HEAT

SET2

1027 : DB

Temperature (Pb1)

1002 : DIF

SET1

On
DO2
Off

On
DO4
Off
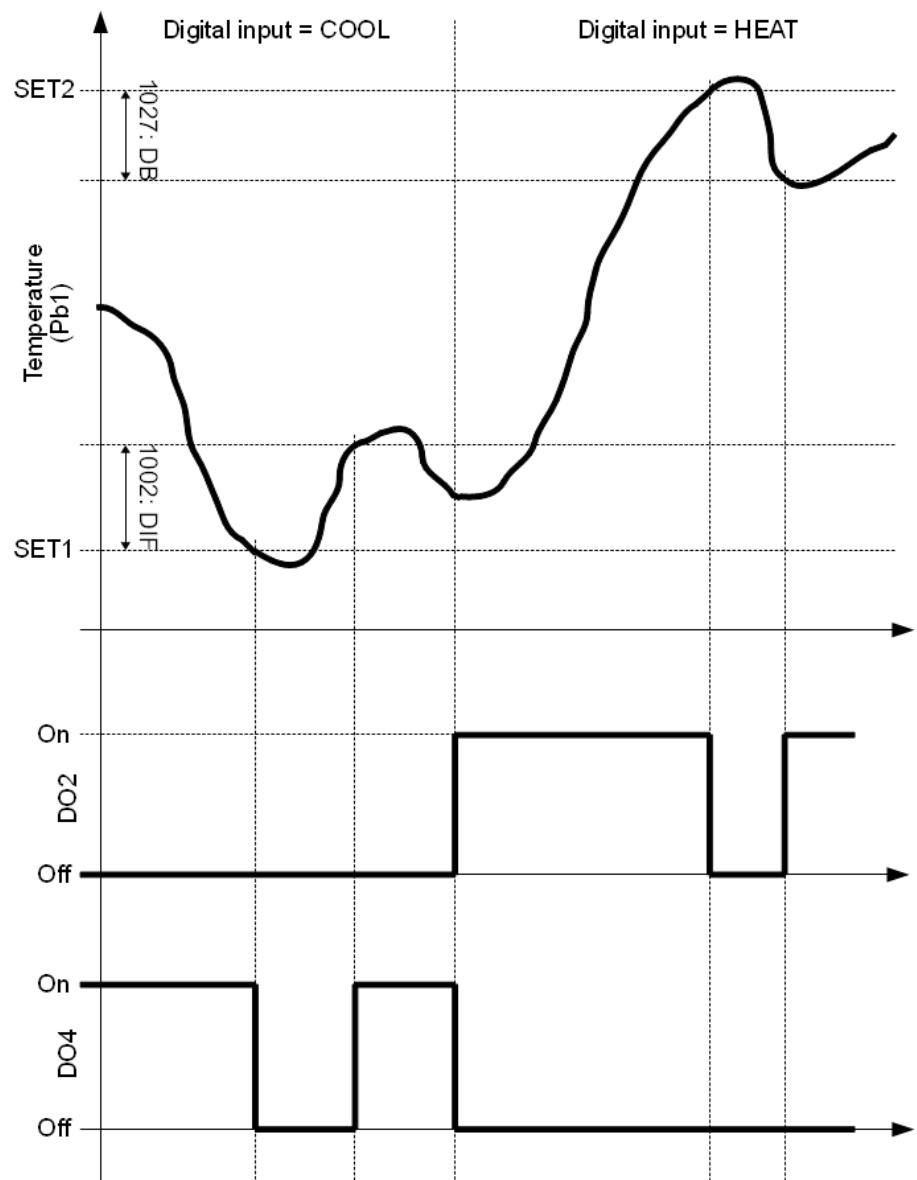
7   DEFROST

Defrost is used to stop ice from forming on the surface of the internal exchanger.

Defrost takes place basically (see *Defrost modes*) by heating up the internal exchanger using:

- electrical heaters;
- hot gas (hot gas solenoid valve);
- by simply stopping the *compressor* and hence the cooling cycle.

Dripping On completion of defrost, given that there will be water on the internal exchanger, it is better not to start cooling righe away as this would ruin the effect of the defrost by creating ice immediately.

The dripping interval is regulated via parameter **1044: DT**.

7.1   Defrost conditions and function

Defrosting is enabled if:

- the internal exchanger temperature is lower than the end defrost temperature set in parameter **1034: DST**;
- manual defrosting has not already been activated, in which case the request for automatic defrost will be canceled.

Defrost request Defrost request can be made in the following ways:

Event	Condition
Application switch-on	If parameter **1036: DPO** (defrost at switch on) is programmed accordingly
Time interval	If **1029: DIT** > 0 each time the defrost time interval set in parameter **1029: DIT** has elapsed
Clock (default)	If **1029: DIT** = 0 and **1032: DCT** = Clock and Clock alarm not active. Defrost is triggered at the times set in Defrost times menu

7.1.1   Automatic defrost

Automatic defrost start request The defrost cycle is programmed to start at time intervals set in parameter **1029: DIT** > 0. Parameter **1032: DCT** determines how that time interval is counted.

To disable the automatic cycle, set **1029: DIT** = 0.

See automatic defrost with the Real Time Clock to run defrosts at given times.

1032: DCT	Description	Notes
Compressor up-time	Running time in hours of the compressor (DIGIFROST® method)	In this case, the counter runs only if the compressor is on. A new count starts when the defrost interval elapses and a new defrost cycle starts if conditions permit). Please note that compressor running time is counted independently from the internal exchanger temperature. If the internal exchanger probe is missing or faulty, the count continues for the time the compressor is on.
Unit up-time	Running time of the application (in ON state)	The defrost time interval is counted continuously when the application is ON and starts at each power-on. A defrost cycle starts when the defrost interval elapses (indicated by **1029: DIT**) if conditions permit and the controller immediately starts counting a new defrost interval.
On compressor stop	On compressor stop	Each time the compressor stops, a defrost cycle is run according to the mode set in parameter **1028: DTY**.
Clock	Con RTC (DEFAULT)	At the times set in Defrost times menu

Automatic defrost start conditions Regardless of how the interval is counted, the following conditions apply:

- if the internal exchanger probe temperature is greater than **1034: DST**, defrost will not be permitted: a new interval will be counted and only at the end of this subsequent count will conditions be tested for the start of

a defrost cycle.

7.1.2 Automatic defrost with Real Time Clock

Defrost times menu

Defrost time menu allows the definition of precise times in the day when an automatic defrost request should be considered by the application.

Times for working days are separated from times for the weekend (5+2 schema).

```
Defrost time events

Working days
    Weekend

       ◖◗
```

Both in the case of working days and in the case of weekend days, you can set up to 8 times in the day at which the automatic defrost request is issued.

```
Weekend
1) 00:00 5) 00:00
2) 00:00 6) 00:00    ✔
3) 00:00 7) 00:00
4) 00:00 8) 00:00    ◖◗
```
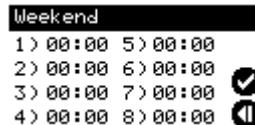
☞ Note that a strict chronological sequence is not mandatory (you may enter the times in any order).

Defrost times exclusion

To not use any of the defrost times you can simply exclude them by increasing the hour value up to 24, which indicates that the parameter is deactivated.

7.1.3 Manual defrost

Manual defrost request

Pressing the manual defrost button will start the defrost cycle, which can also be started from *digital input*, if properly configured.

Procedures for the activation of this defrost cycle are the same as for external defrost.

The defrost interval will now be counted as described for automatic defrost (time **1189: DET** is not cleared, it continues).

Notification of a discarded defrost request

If conditions do not permit (internal exchanger temperature greater than the value set in parameter **1034: DST**), this will be signaled on the display (defrost icon blinks) and defrost will stop.

7.1.4 External or manual defrost

Time graphs for signals in each of the various function modes are presented below.

IN	Defrost request
OUT	Output state for defrost regulator. Note that (**1034: DST**) indicates defrost end due to temperature setpoint fulfillment.

Defrost request diagrams
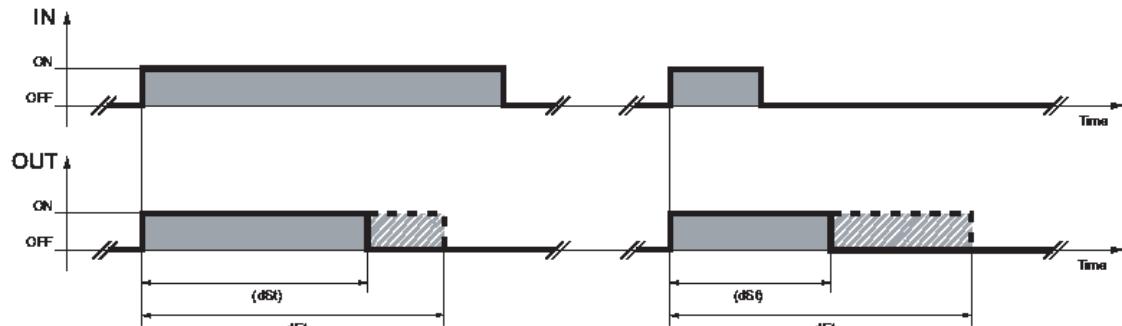
⚠ Defrost is activated on the rising edge. Hence, you can only activate a defrost, not stop one that is underway. Defrost and dripping currently underway and the defrost or dripping interval count cannot be suspended.

7.2 Defrost modes

Defrost can be activated in four ways, as set in parameter **1028: DTY**.

Defrost termination condition

Whatever the case, defrost is terminated when the following conditions hold:

1181: H42	Termination conditions
= Disabled (Evaporator probe not present)	After the timeout set in parameter **1189: DET** (defrost timeout) occurred
≠ Disabled (evaporator probe present)	After reaching defrost end temperature set in parameter **1034: DST**. If the temperature is not reached before the time set in parameter **1189: DET** (defrost timeout) elapses, defrost is terminated.

7.2.1   Defrost with compressor stopped (DEFAULT)

The defrost cycle with the compressor stopped is configured by setting parameter **1028: DTY** = Electric.

Compressor stops for the duration of the defrost, and defrost relay does not exist (parameter **H22** ≠ Electric defrost).

On completion of defrost, the compressor relay stays off during the dripping time set in **1044: DT** if it is not equal to zero.
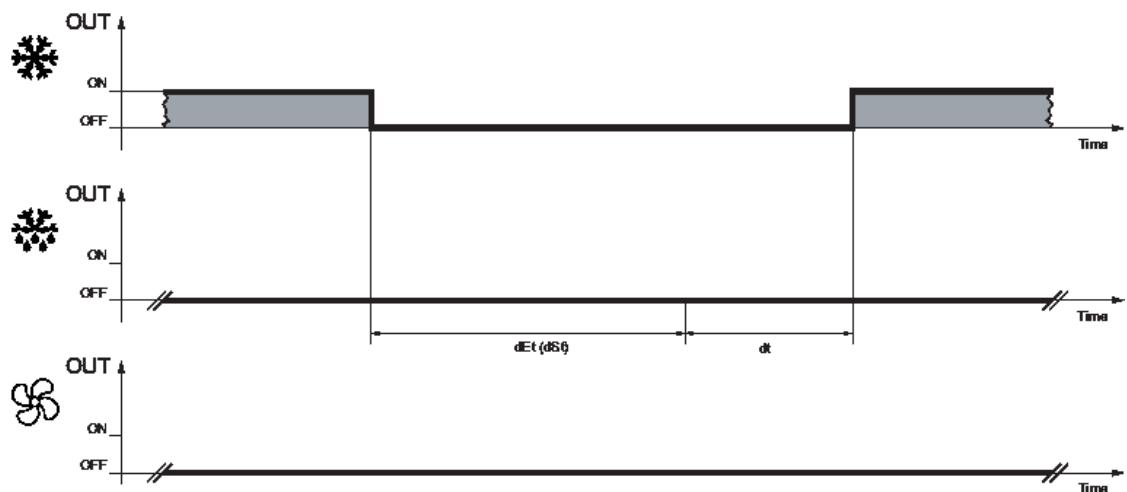
7.2.2   Defrost with electrical heaters

Defrost with electrical heaters is configured by setting **1028: DTY** = Electric and parameter **H22** = Electric defrost.

The *compressor* stops for the duration of the defrost cycle and the relay configured as defrost regulator output and that the electrical heaters are connected to activates.

On completion of defrost, the electrical heaters are switched off and the compressor remains off for the dripping time set in parameter **1044: DT**, if it is not equal to zero.
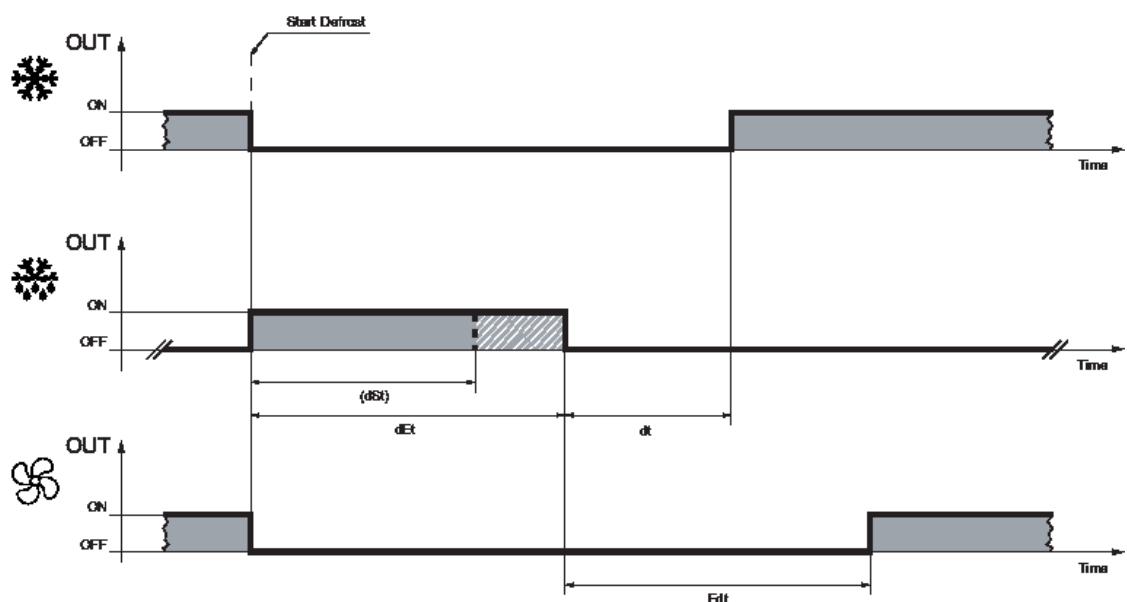
In the diagram, (**1034: DST**) marks defrost termination due to reaching of defrost stop temperature. If **1034: DST** intervenes before **1189: DET**, dripping (**1044: DT** and **1043: FDT**) aligns with **1034: DST**. If **1043: FDT** < **1044: FDT** then will force **1043: FDT** = **1044: DT**.

During defrost, fans are off if parameter **1045: DFD** is set accordingly, otherwise they remain under the control of their own regulator.

7.2.3   Hot gas defrost

Hot gas defrost is configured by setting parameter **1028: DTY** = Cycle inversion and parameter **H22** = Electric defrost.

The *compressor* stays on for the entire duration of the defrost cycle and the relay configured as defrost regulator output and that the solenoid valve is connected to activates.

On completion of the defrost cycle, the solenoid valve relay is switched off and the dripping set in parameter **1044: DT** in enabled if not equal to zero. The compressor relay is once again controlled by the compressor regulator.

⚠️ Parameters **1011: DON** / **1012: DOF** / **1013: DBI** (see *Compressor safety times*) have priority.

7.2.4   Defrost in FREE mode

Defrost cycle in FREE mode is configured by setting parameter **1028: DTY** = Free.

The *compressor* remains under the control of the compressor regulator for the duration of the defrost cycle and the relay configured as defrost and that the defrost heaters are connected to activates.

The heaters are switched off on completion of the defrost cycle. During dripping, the compressor continues to regulate.

7.2.5   Defrost regulator protection and constraints

Defrost timeout If the defrost cycle does not terminate on reaching the end of defrost temperature set in parameter **1034: DST**, a maximum defrost time interval can be set in parameter **1189: DET**. If the defrost cycle terminates for timeout, an alarm can be activated by configuring parameter **1095: DAT** (see defrost timeout *alarm*).

⚠️ Defrost can only be terminated manually by switching the controller on and off again using the ON/OFF function.

Moreover, some alarms may be excluded for a certain amount of time after the defrost cycle ends.

In the event of error **E1** (cold room probe **Pb1** error) defrost cycles will not be run.

8 EVAPORATOR FANS

8.1 Physical configuration

Evaporator fans relay

Evaporator fans are bound to *digital output* (relay) **DO5** (not configurable). Relay polarity is not configurable.

8.2 Operating conditions

Enabling evaporator fans regulation

Evaporator fans regulations is enabled if the following conditions hold:

- application is ON;
- has not been excluded during *defrost* by parameter **1045: DFD**;
- delay after defrost is not active (parameter **1043: FDT**);
- external alarm is not active while parameter **1096: RLO** requires fans are halted in such a condition;
- *pressure switch* alarm (caused by a number of pressure switch events greater than parameter **1115: PEN** in the time interval defined by parameter **1116: PEI**) is not active.

Evaporator fans relay inhibition

Relay bound to evaporator fans is inhibited if:

- door is open and parameter **1047: FOD** = Not active;
- time set in parameter **1014: ODO** has not elapsed yet.

8.3 Operating modes

In cooling, evaporator fans work as shown in this diagram.

	Compressor ON	*Compressor* OFF
Evaporator probe **Pb2** not available (**1181: H42** = Disabled)	ON	OFF
Evaporator probe **Pb2** error	ON	OFF
Evaporator probe available (**1181: H42** ≠ Disabled) and **1046: FCO** = Not active (fans OFF if compressor OFF)	THERMOSTAT CONTROLLED	OFF
Evaporator probe available (**1181: H42** ≠ Disable) e **1046: FCO** = Thermostat controlled	THERMOSTAT CONTROLLED	THERMOSTAT CONTROLLED

Thermostat control of evaporator fans

Thermostat control of fans takes place at the values set in parameters **1040: FST** (block fans temperature) and **1042: FAD** (fans differential). Block fans temperature is absolute (real temperature value).

The fan regulator functions as indicated below.
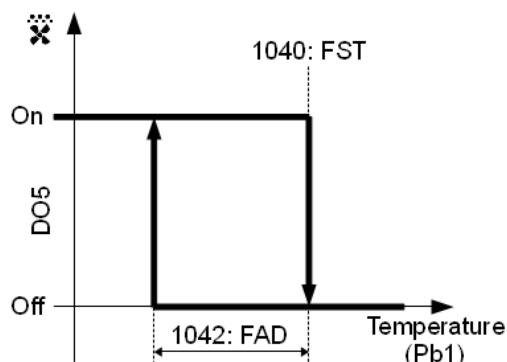
9   VENTILATION FANS

9.1   Physical configuration

Ventilation fans relay

To bind a *digital output* (relay) to ventilation fans either parameter **1168: H26** or **1169: H27**, found in menu Configuration, must be set accordingly.

Default configuration does not bind any relay to ventilation fans.

9.2   Operating conditions

Ventilation fans regulation is enabled if the following conditions hold:

- application is ON;
- ventilation is not switched off from *digital input*, if it has been configured as ventilation request by setting **1159: H11** / **1160: H12** = ±15;
- ventilation fans relay is not disabled in the active *thermal profiles* program step (parameters **nP7** = No, where n is the active step).

9.3   Operating modes

Ventilation fans duty cycle

Ventilation fans are regulated in a duty cycle defined by parameters **1072: CON** and **1073: COF**, according to the rules reported in the following table.

1072: CON	1073: COF	relay
0	0	OFF
0	> 0	OFF
> 0	0	ON
> 0	> 0	Duty cycle

Regulation diagram

Ventilation fans operation is depicted in the following diagram.
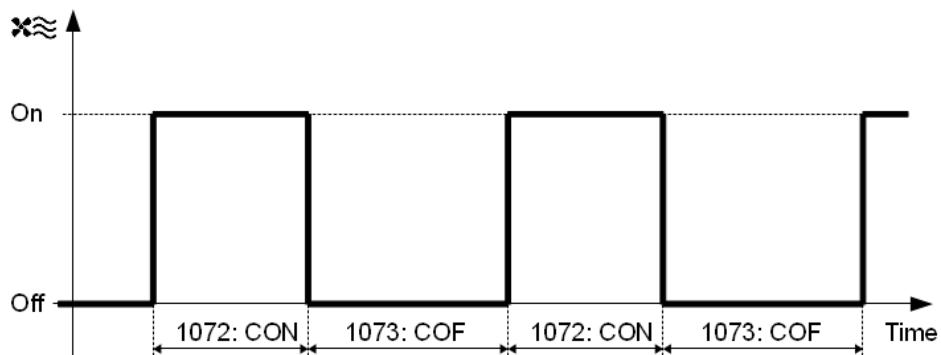
9.4   Programming

Parameters related to ventilation fans can be viewed and configured in the folders:

- the Ventilation fan folder in the installer menu (**1072: CON** and **1073: COF**);
- the Configuration folder in the installer menu (**1159: H11** / **1160: H12** and **1168: H26** / **1169: H27**).

10   ANALOG OUTPUT

The application manages one analog output ad the output of a widely-parametric cut-off regulator.

As an example, the regulator may be used to regulate the fan unit on the outside of the heat exchanger that normally serves as a condenser. Various types of fan pilot modules can be connected depending on relative availability and the setting of *analog output* BIOS parameter (see FREE Evolution Installation Manual, for details).

10.1   Physical configuration

The cut-off regulator is bound to *analog output* **AO1** (not configurable).

10.2   Operating conditions

The cut-off regulator associated to analog output is enabled if the following conditions hold:

- application is ON;
- regulator has been enabled by setting parameter **1051: F00** properly and **Pb4** probe is enabled, too (parameter **1183: H44** ≠ Disabled);
- either the cut-off regulator is independent of the *compressor* (**1067: F16** = Not active) or there is a switch on request coming from the *compressor*.

10.3   Operating modes

10.3.1   Start-up time

Start-up time

On each start-up of the cut-off regulator, the *analog output* is forced to its maximum value for the start-up time set in parameter **1054: F03**, after which the *analog output* is set to the value determined by the cut-off regulator.

10.3.2   Regulation on compressor request

Cut-off regulator can be configured to be independent of or dependent on the *compressor* state, by means of parameter **1067: F16**, which determines whether the cut-off regulator can be enabled if *compressor* is off.

10.3.3   Cut-off bypass time

Cut-off bypass time

By means of parameter **1069: F18** a cut-off bypass time can be set; during this period, if the regulator requests the cut-off, the *analog output* is forced to the value set with parameter **1057: F06** (minimum level).

10.3.4   Pre-ventilation

If the fan is activated by a compressor call (see paragraph *Regulation on compressor request*), the compressor ON signal is given only after the regulator has run for the minimum time given in parameter **1070: F19**.

Pre-ventilation is run to prevent the compressor from switching on at excessively high condensation temperatures.

10.3.5   Regulation

The diagrams below plot the *analog output* level as a function of the value read from the regulation probe and the cut-off regulator parameters.

The following diagram refers to cooling mode (**1052: F01** = Cool).

Cut-off regulator diagram in cooling mode
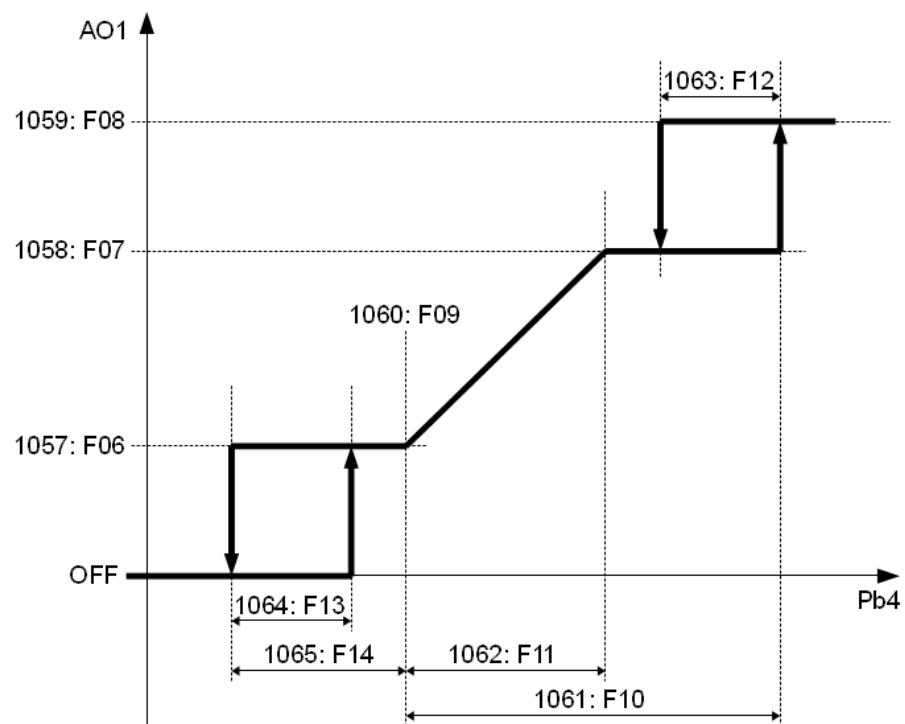
The following diagram refers to heating mode (**1052: F01** = Heat).

Cut-off regulator diagram in heating mode
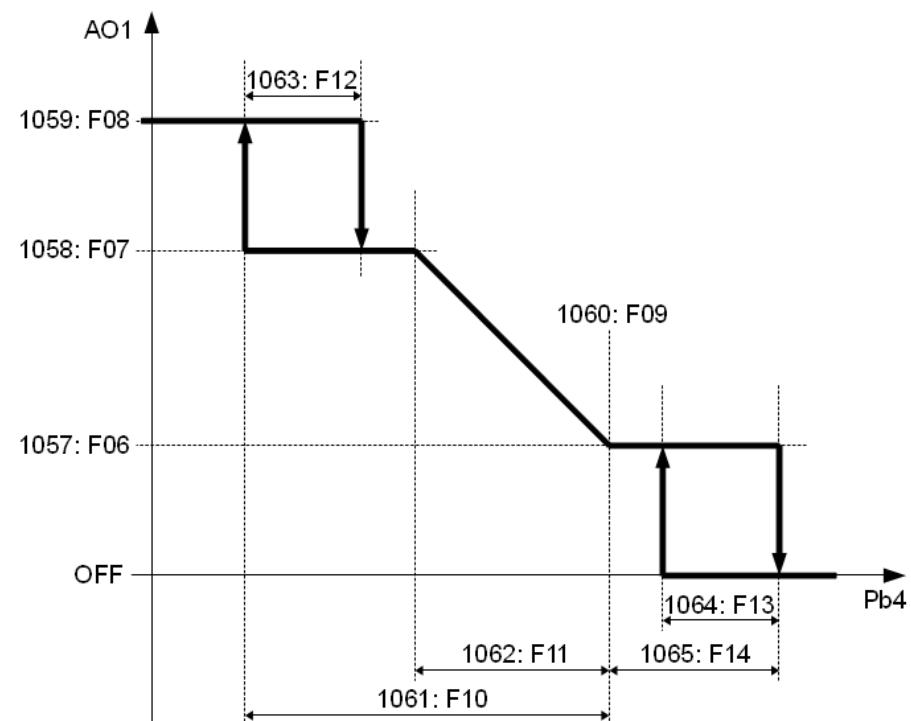
10.4   Programming

Cut-off regulator *parameters* can be viewed and configured in:

- the Analog output folder of the installer menu (**1051: F00** … **1071: F20**);
- the Configuration folder of the installer menu (parameter **1183: H44**).

11   PRESSURE SWITCH

The application performs diagnostic operations over a *digital input* associated via a configuration table. It is activated by setting paramters **1159: H11** / **1160: H12** = ±11.

11.1   Operating modes

Pressure switch event effect

If the pressure switch input is activated, power to the *compressor* is immediately cut off, the relative *alarm LED* lights up to indicate this visually and the alarm folder also displays the proper error message.

Pressure switch event count

Pressure switch diagnostics is configured by means of parameters **1115: PEN** and **1116: PEI**. The time **1116: PEI** is counted down starting at the first pressure switch event.

Pressure switch alarm

An alarm is generated only if the maximum number of events **1115: PEN** is reached before the time set in parameter **1116: PEI** elapsed; in this case, *compressor*, *evaporator fans* and *defrost* output are disabled and manual rearm of the alarm condition is required.

If the number of activations does not exceed the number set in parameter **1115: PEN** in the time interval set in parameter **1116: PEI** alarm condition is automatically rearmed.

If **1115: PEN** = 0 pressure switch diagnostics is inhibited.

11.1.1   Alarm reset

Once the controller is in alarm state, it must be powered off and then powered on again, or a reset request may be issued from either the active alarms menu or the functions menu.

12.1   Operating conditions

Relative humidity regulation (humidification and dehumidification) is enabled provided that:

- application is ON;

Configurazione regolazione umidità relativa

- regulation is enabled by setting **1154: H05** according to the following table and probe **Pb3** is enabled, too (parameter **1182: H43** ≠ Disabled);

1154: H05	Humidification	Dehumidification
Disabled	Disabled	Disabled
Neutral zone	Enabled	Enabled
Humidification	Enabled	Disabled
Dehumidification	Disabled	Enabled

- alarm **E3** is not active (humidity probe **Pb3** error);

- during *defrost*, regulation is not excluded by means of parameter **1024: DEH**.

12.2   Humidification

Application accomplishes the humidification task by means of an ON/OFF regulator with differential. The regulator output is bound to a relay, to which a humidifier has to be connected.

12.2.1   Physical configuration

Humidifier relay

The humidifier is bound to *digital output* (relay) **DO1** (not configurable). Relay polarity is not configurable.

For information about connecting the humidifier to the device, refer to FREE Evolution Installation Manual.

12.2.2   Operating modes

Humidification diagram

The following diagram plots the state of the humidification relay as a function of the cell relative humidity. Differential **1021: DBH** is always positive.
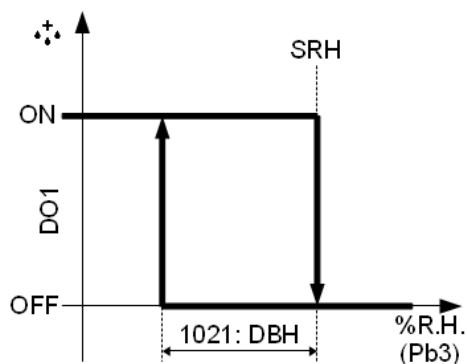
12.3   Dehumidification

Application accomplishes the dehumidification task by means of an ON/OFF regulator with differential. The regulator output is bound to one or more relays, depending on the selected *dehumidification mode*.

12.3.1   Dehumidification modes

Parameter **1158: H09** determines the selected dehumidification mode, according to the following schema.

1158: H09	Description
Relay only	Dehumidification with dedicated relay
Relay and compressor	Dehumidification with both dedicated relay and compressor
No relay	Dehumidification with compressor and heating relay

12.3.2 Physical configuration

Dehumidification relay

Dehumidifier is bound to *digital output* (relay) **DO3**, if enabled with parameter **H22**. Default configuration enables the dehumidifier relay.

For information about *compressor relay* and *heating relay* configuration see the corresponding sections in this document.

12.3.3 Operating modes

Dehumidification diagram

The following diagram plots the state of dehumidification as a function of the cell relative humidity. Differential **1021: DBH** is always positive.
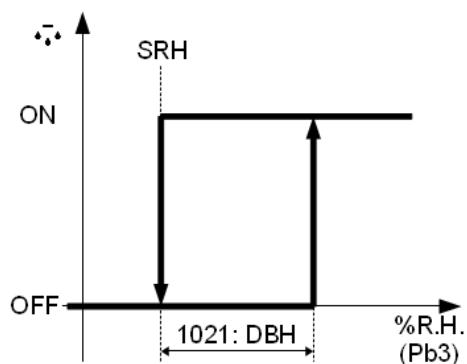
Dehumidification mode determines which relays are activated if dehumidification is on.

12.4 Programming

Parameters related to relative humidity regulation can be viewed and configured in:

- Humidity folder in the installer menu;
- Configuration folder in the installer menu (**1154: H05** / **1158: H09** / **1182: H43**).

Humidity setpoint can be set either from the *main view* or from a dedicated menu (setpoint menu).

13 THERMAL PROFILES

Application has an 8 step thermal profile. Each step is defined by a set of 10 parameters.

13.1 Programming

Thermal profiles menu

Parameters related to the thermal profiles program can be viewed and configured in the Thermal profiles menu, available in the *main menu*.

```
Thermal profile
 Step 1    Step 5
 Step 2    Step 6
 Step 3    Step 7
 Step 4    Step 8  ◖
```

Each step has a dedicated sub-menu containing all its parameters.

```
Step 1          0/0
1P0
       Delay
              0 min
 ≫              ≪
```

13.2 Enabling the program

The thermal profiles program is enabled if automatic mode is switched on in the Functions menu, available in the *main menu*.

```
Functions       0/0
Economy         Off
Automatic       Off
Reset alarms    Off
 ≫              ≪
```

Thermal profiles program display

Main view display textual information about the state of the thermal profiles program:

<div align="center">STEP 1: RUN 02:38</div>

where:

- STEP indicates automatic mode is on;
- 1 is the number of the active step;
- START / RUN / STOP HH:MM is the program running state.

13.3 Program control

13.3.1 Program START

In START state, the *main view* displays the following text:

<div align="center">STEP 1: START 08:30</div>

where:

- 08:30 is the program start-up time (--:-- if not specified).

Program can be started:

- from the thermal profiles program control panel, available in the *main view*;

- a *digital input* properly configured by setting parameter **1159: H11** / **1160: H12** = ±21 (toggle START/STOP);
- at the time set directly in the *main view*:

<div align="center">STEP 1: START 01:43</div>

13.3.2 Program RUN

In RUN state, the *main view* displays the following text:

<div align="center">

`STEP 1: RUN 01:57`

</div>

where:

- `1` is the currently active step;
- `01:57` is the step remaining time.

Step duration can be changed at run-time directly from the *main view*.

13.3.3 Program STOP

Program can be stopped:

- from the thermal profiles program control panel, available in the *main view*;
- a *digital input* properly configured by setting parameter **1159: H11** / **1160: H12** = ±21 (toggle START/STOP);

13.3.4 Program RESET

Program is reset from the thermal profiles program control panel, available in the *main view*.

13.4 STEP behavior

Thermal profiles program step parameters

The following table describes the parameters defining the application behavior when a thermal profiles program step is active.

Parameter	Description	Meaning
nP0	Step activation delay	Step activation delay, in minutes, after a START event.
nP1	Step duration	Determines the step duration, in minutes. If **nP1** = 0 step stops when the temperature setpoint is reached (does not stop due to a timeout).
nP2	*Relative humidity regulation* type	Determines the *relative humidity regulation* type while the step is active (overwrites parameter **1154: H05**).
nP3	*Thermoregulation* type	Determines the *thermoregulation* type while the step is active (overwrites parameter **1156: H07**).
nP4	Humidity setpoint	Determines the *relative humidity regulation* setpoint while the step is active (overwrites parameter **SRH**).
nP5	Temperature setpoint 1	Determines *thermoregulation* setpoint while the step is active (overwrites **SET1**).
nP6	Temperature setpoint 2	Determines **thermoregulation** setpoint while the step is active (overwrites **SET2**).
nP7	Enable/Disable *ventilation fans* relay	Determines whether *ventilation fans* relay is enabled/disabled while the step is active. If no relay is configured for this purpose, this parameter has no effect.
nP8	End step action	Determines the action taken at the end of the step and determines the active setpoint during the delay defined by parameter **(n+1)P0**, if ≠ 0. Available actions are: {nested table}

Nested table in nP8 cell:

nP8	Description
End	End of thermal profiles program.
Next (continue) (*)	Go to next step. Keep current setpoint during next step's activation delay.
Next (wait) (*)	Go to next step. Halt regulation, waiting for a new setpoint,

Parameter	Description	Meaning

		nP8	Description
			during next step's activation delay.
		Loop	Go back to the start of the step.
		Go to step	Return to step number **nP9**.
		Everlasting	Unlimited duration.
		(*) value has no effect during STEP 8 (there are no further steps)	
nP9	Jump back target	Determines the jump back target if **nP8** = Go to step.	

13.5   Example

The following example discuss a simple 3-step thermal profiles program where both thermoregulation and relative humidity regulation are in neutral zone.

Step	Delay (**nP0**)	Duration (**nP1**)	Regulation type (**nP2** / **nP3**)	Humidity setpoint (**nP4**)	Temperature setpoint (**nP5**)
Step1	Delay 1	Endurance 1	NZ / NZ	Humidity	Setpoint temperature A
Step2	/	Endurance 2	NZ / NZ	Setpoint humidity	Setpoint temperature B
Step3	/	Endurance 3	NZ / NZ	Setpoint humidity	Setpoint temperature A
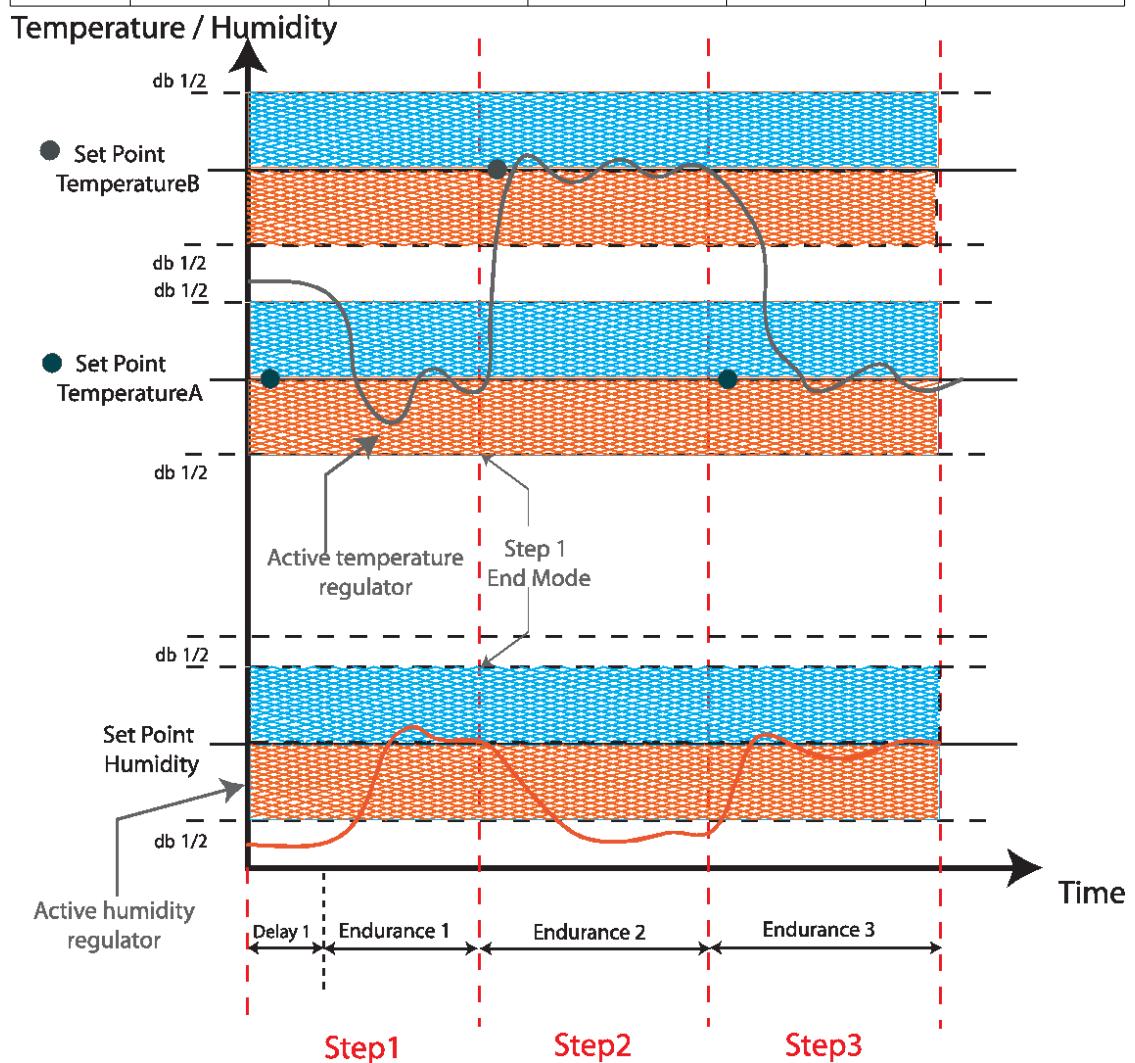
14   ALARMS AND DIAGNOSTICS

The application is able to perform complete diagnostics of the system and report any operating trouble with specific alarms.

Alarms are always reported by::

- alarm *icon* shown on the display;

- FREE Evolution programmable controller's alarm *LED*.

14.1   Probe error

Probe errors are caused by:

- measured values are outside the nominal range;

- probe faulty / short-circuited / open.

Active probe errors are displayed in the active alarm menu.

The table below lists probe errors.

Error code	Probe error	Effect
E1	Probe **Pb1** error (cell temperature)	*compressor duty cycle* according to parameters **1009: ONT** and **1010: OFT** - heating regulator disabled - high/low temperature diagnostics is disabled - currently active step of the *thermal profiles program* is forced to stop, if it is configured with unlimited duration (termination after reaching temperature setpoint)
E2	Probe **Pb2** error (evaporator temperature)	*defrost* termination due to timeout, not because temperature setpoint has been reached *evaporator fans* regulation depends upon *compressor* state
E3	Probe **Pb3** error (cell relative humidity)	*relative humidity regulation* disabled - high/low humidity diagnostics is disabled
E4	Probe **Pb4** error (*cut-off regulator* feedback)	*analog output* bound to the *cut-off regulator* is regulator acording to parameter **1071: F20** (either off or forced to maximum level)

14.2   Alarms

The following table lists all the application alarms, error probes excluded.

Error code	Alarm	Cause	Effect	Solution
08	High temperature	See *High/Low alarms*	No effect on regulation (warning only)	Wait for the temperature value read by probe **Pb1** (cell temperature) to fall below **1081: HAL**
09	Low temperature	See *High/Low alarms*	No effect on regulation (warning only)	Wait for the temperature value read by probe **Pb1** (cell temperature) to rise above **1082: LAL**
19	High humidity	See *High/Low alarms*	No effect on regulation	Wait for the

Error code	Alarm	Cause	Effect	Solution
			(warning only)	humidity value read by probe **Pb3** (cell humidity) to fall below **1089: HHA**
20	Low humidity	See *High/Low alarms*	No effect on regulation (warning only)	Wait for the humidity value read by probe **Pb3** (cell humidity) to fall below **1090: LHA**
01	External alarm	Due to activation of the *digital input* configured as alarm (**1159: H11 / 1160: H12** = ±5)	Blocks regulators in accordance with parameter **1096: RLO**	Regulators resume normal operation upon subsequent deactivation of the *digital input*
13	*Defrost* timeout	Interruption of *defrost* due to timeout instead of reaching *defrost* end temperature (read from probe **Pb2**, evaporator temperature)	No effect on regulation (warning only)	Manual alarm reset required
03	Door open alarm	After the delay **1086: TDO** since door opening	No effect on regulation (warning only)	Alarm remains active until the door is closed
02	Panic alarm	Due to activation of the *digital input* configured as panic alarm (**1159: H11 / 1160: H12** = ±18)	No effect on regulation (warning only)	Alarm remains active until subsequent deactivation of the *digital input*
04	*Pressure switch* alarm	See *Pressure switch*		
RTC	Clock error	Real Time Clock error (see FREE Evolution Installation Manual)	Clock-related functions are disabled: automatic *defrost* on time events; *thermal profiles program start*-up time	See FREE Evolution Installation Manual

14.3 High/Low (temperature / relative humidity) alarms

High/Low alarms indicate that user-defined temperature/relative humidity thresholds have been crossed.

14.3.1 High/Low temperature alarms configuration

High/Low temperature alarms refer to values read by probe **Pb1** (cell temperature).

High/Low temperature thresholds

Temperature thresholds are set with parameters **1081: HAL** and **1082: LAL**. Parameter **1079: ATT** determines whether they represent absolute temperature values (**1079: ATT** = Absolute) or values relative to current temperature setpoint (**1079: ATT** = Relative).

OUT
((●))

ON
OFF
Temp.

ON
OFF
Temp.

LAL   AFd   AFd
HAL

OUT
((●))

ON
OFF
Temp.

ON
OFF
Temp.

AFd   AFd
SEt + LAL   SEt + HAL
SEt
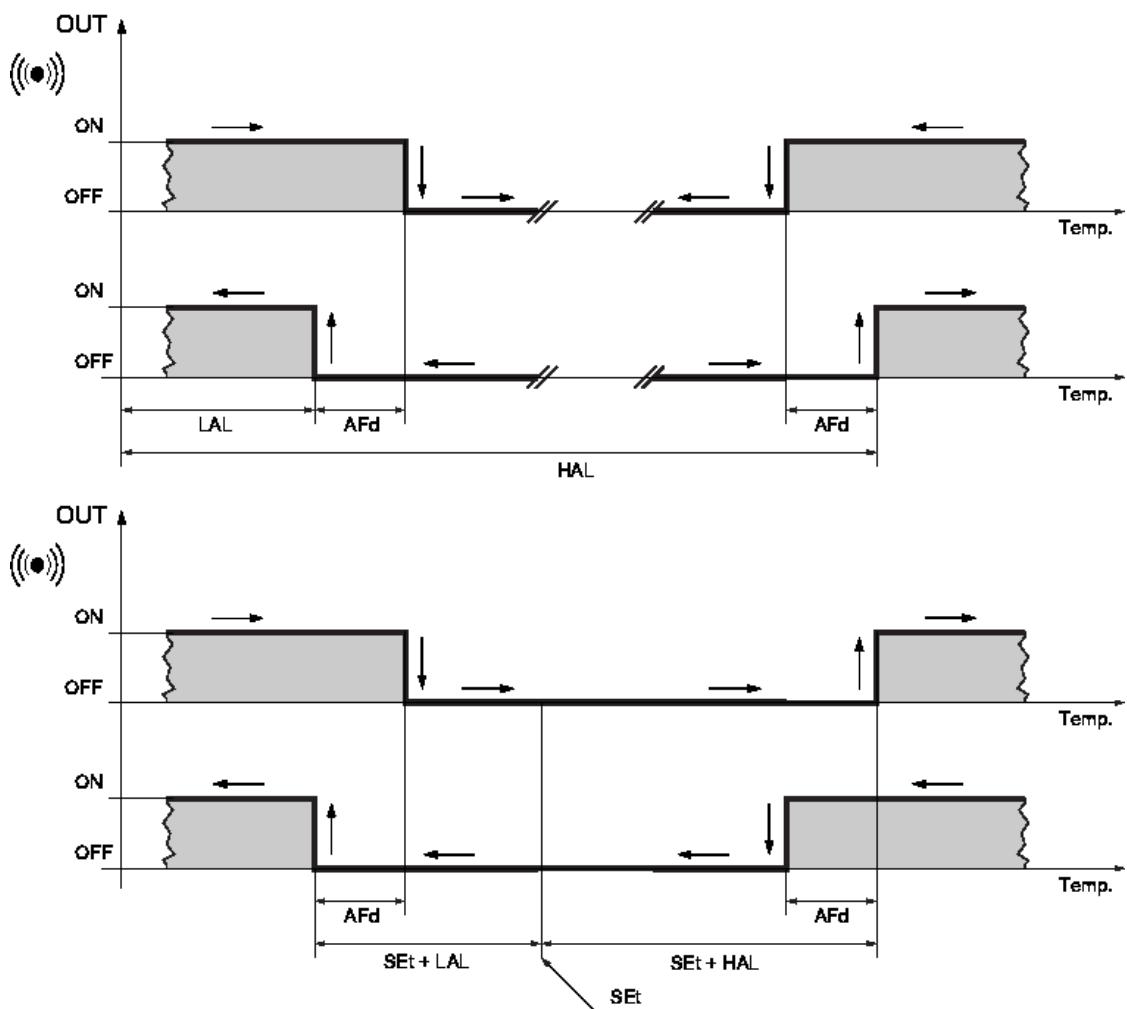
⚠ To generate an alarm when the value falls below the setpoint when **1079: ATT** = Relative, a negative value must be entered for **1082: LAL**.

Power-on exclusion

Using parameter **1083: PAO** you can set an exclusion time for high/low temperature alarms following the device power-on.

Alarm exclusion after defrost

Using parameter **1084: DAO** you can set an exclusion time for high/low temperature alarms following defrost termination.

Alarm exclusion after door closure

Using parameter **1085: OAO** you can set an exclusion time for high/low temperature alarms following the door closure.

During the time intervals defined by parameters 1083: PAO / 1084: DAO / 1085: OAO, the regulator is disabled and any temperature alarms are not signaled.

Alarm signal delay

Using parameter **1087: TAO** you can set a delay for the signaling of the alarm when it occurs.

14.3.2 High/Low humidity alarms configuration

High/Low humidity alarms refer to values read by probe **Pb3** (cell humidity).

High/Low humidity thresholds

Humidity thresholds are set with parameters **1089: HHA** and **1090: LHA**. Parameter **1088: ATH** determines whether they represent absolute humidity values (**1088: ATH** = Absolute) or values relative to current humidity setpoint (**1088: ATH** = Relative).

⚠ To generate an alarm when the value falls below the setpoint when **1088: ATH** = Relative, a negative value must be entered for **1090: LHA**.
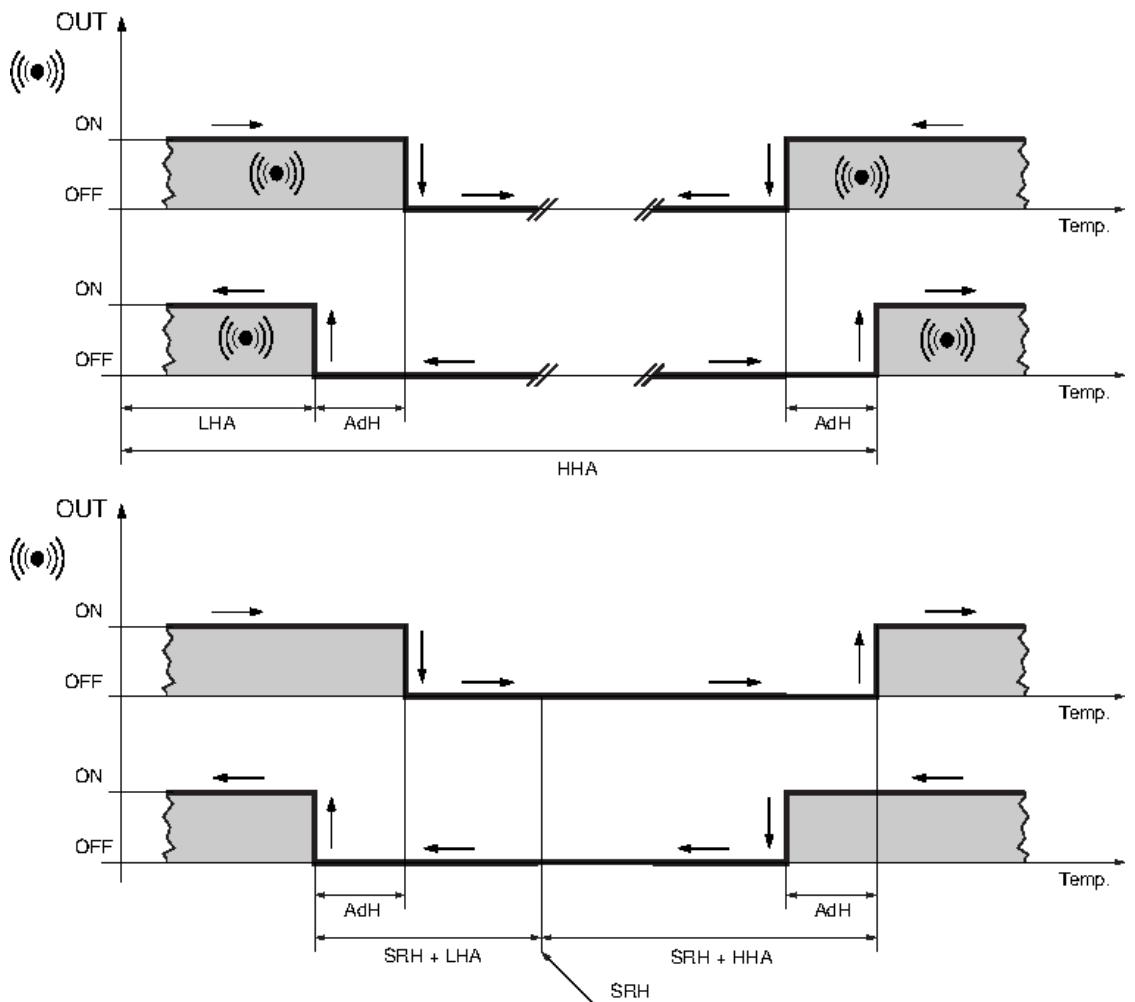
Power-on exclusion	Using parameter **1093: PAH** you can set an exclusion time for high/low relative humidity alarms following the device power-on.
Alarm exclusion after door closure	Using parameter **1094: OAH** you can set an exclusion time for high/low relative humidity alarms following the door closure.
	During the time intervals defined by parameters **1093: PAH** / **1094: OAH**, the regulator is disabled and any relative humidity alarms are not signaled.
Alarm signal delay	Using parameter **1092: AOH** you can set a delay for the signaling of the alarm when it occurs.

15   PARAMETERS

Parameters can be set to fully configure the application.

They can be modified with:

   • the application *user interface*;

   • a Personal Computer and the FREE Studio Device software tool.

The following sections analyze each parameter, divided into categories (folders), in detail. The parameters are listed below in tables.

Each parameter is identified on the display as follows:

```
Compressor       0/0
1002: DIF
      Differential
                  0 °C
    ⤒              ⤓
```

where:

   • `Compressor` indicates folder;

   • `(1/11) 1` indicates the number of the parameter, `11` the total number of parameters displayed in the folder (this number depends on whether the menu is accessed from the User menu or the Installer menu);

   • `1002: DIF` is the unique parameter ID;

   • `Differential` is the parameter description;

   • `0 °C` is the parameter value.

Some parameters are visible only if installer access rights have been granted: please refer to the parameter reference table at the end of the chapter for this information.

15.1   Compressor

1002: DIF | **Differential**

Compressor relay activation differential; the compressor stops on reaching the Setpoint value (as indicated by the adjustment probe) and restarts at a temperature value equal to the Setpoint plus the value of the differential.

1003: HSE | **Setpoint MAX**

Maximum value that can be assigned to the setpoint.

1004: LSE | **Setpoint MIN**

Minimum value that can be assigned to the setpoint.

NOTE: The two sets are interdependent: **1003: HSE** (maximum setpoint) can not be less than **1004: LSE** (minimum setpoint), and viceversa.

1005: OSP | **Economy setpoint**

Temperature value to be added algebraically to the setpoint if reduced set enabled (Economy function). It can be activated with a key stroke, by a function or a digital input configured for this purpose.

1006: HC | **Mode**

Compressor operating mode. If **1006: HC** = Heat, compressor integrates the heating regulator and the application can not do cooling anymore (parameter **1156: H07** should be set accordingly).

1009: ONT | **Duty cycle time on**

Actuation time (in minutes) of the compressor due to a probe failure (see *compressor duty cycle*).

1010: OFT | **Duty cycle time off**

Shutdown time (in minutes) of the compressor due to a probe failure (see *compressor duty cycle*).

1011: DON | **On start delay**

The parameter indicates that a protection is active on the relay actuation of the compressor. The time indicated must elapse between the request and the actual activation of the compressor relay.

1012: DOF	**Stop-start delay**
	The parameter indicates that a protection is active on the relay actuation of the compressor. The time indicated must elapse between the request and the actual activation of the compressor relay
1013: DBI	**Start-start delay**
	Delay between activations; the delay time indicated must elapse between two consecutive activations of the compressor.
1014: ODO	**Power-on delay**
	Delay in activating outputs after the controller is switched on or after a power failure.
	If **1014: ODO** = 0, not active.

15.2 Humidity

1021: DBH	**Differential**
	Relative humidity regulation differential.
1022: HSH	**Setpoint MAX**
	Maximum value that can be assigned to the humidity setpoint.
1023: LSH	**Setpoint MIN**
	Minimum value that can be assigned to the humidity setpoint.
1024: DEH	**While defrosting**
	Relative humidity regulation while defrosting. If **1024: DEH** = Not active, relative humidity regulation is not active during defrost; if **1024: DEH** = Active, relative humidity regulation is active during defrost.
1027: DB	**Heating band**
	Heating regulation band.

15.3 Defrost

1028: DTY	**Type**
	Defrost mode.
	If **1028: DTY** = Electric, electric defrost (OFF Cycle defrost, that is compressor not running during defrost). NOTE: electrical defrost + air defrost, in the case of fans in parallel with the defrost output relay).
	If **1028: DTY** = Cycle inversion, cycle inversion defrost (hot gas, or compressor running during defrost).
	If **1028: DTY** = Free, defrost with Free mode (independent of compressor status).
1029: DIT	**Time interval**
	Time interval between the start of two subsequent defrosting cycles. Times are expressed in hours.
	This parameter is used in automatic defrosts at fixed intervals. If **1029: DIT** = 0 there is no automatic defrost: defrost in never executed.
1032: DCT	**Counting type**
	Selects the count mode for the defrost interval.
	If **1032: DCT** = Compressor up-time (DIGIFROST® method), counter is incremented only with the compressor on. Compressor running time is counted separately from the evaporator probe (count active if evaporator probe missing or faulty).
	If **1032: DCT** = Unit up-time, defrost count is always active when the application is on.
	If **1032: DCT** = On compressor stop, a defrost cycle is run at each compressor stop, depending on the parameter **1028: DTY**.
	If **1032: DCT** = Clock, a defrost cycle is run at each time set in the defrost times menu.
1033: DOH	**Power-on exclusion**
	Defrost exclusion time after switching on application.
1189: DET	**Timeout**

Defrost timeout. Determines the maximum duration of defrosting, in minutes.

1034: DST	**Stop temperature**

Defrost stop temperature measured by defrost probe.

1036: DPO	**At power-on**

Determines if a defrost cycle has to run when the application is switched on.

If **1036: DPO** = Not required, defrost not run at start-up.

If **1036: DPO** = Required, defrost run at start-up.

15.4   Evaporator fans

1040: FST	**Stop temperature**

Fan stop temperature; if the evaporator probe reads a higher value than the set value, the fans are stopped. The value can be positive or negative.

Temperatures are expressed in absolute values.

1042: FAD	**Differential**

Fan activation differential, relative to stop temperature given in parameter **1040: FST**.

1043: FDT	**Delay time**

Fan activation delay after a defrosting cycle.

1044: DT	**Drainage time**

After a defrost cycle, the fans and compressor remain off for the time set in this parameter.

1045: DFD	**While defrosting**

Allows exclusion of the evaporator fans to be selected or not selected during defrosting.

If **1045: DFD** = Not active, fans are off during defrost.

If **1045: DFD** = Active, evaporator fans regulation is active during defrost.

1046: FCO	**If compressor off**

Selects or not fan deactivation at compressor OFF.

If **1045: FCO** = Off, evaporator fans are off if compressor is off.

If **1045: FCO** = Thermostat controlled, evaporator fans are independent of compressor state.

Value **1045: FCO** = Duty cycle is not used.

1047: FOD	**If door open**

Selects fan deactivation when the door is opened and fan restart when the door is shut (if they were running).

If **1047: FOD** = Not active, fans are off if door is open.

If **1047: FOD** = Active, evaporator fans regulation is active when the door is open.

1048: FDC	**Post-ventilation**

Fan switch off delay after compressor stop, in minutes. If **1048: FDC** = 0 this function is excluded.

15.5   Analog output

1051: F00	**Configuration**

Enable/Disable cut-off regulator.

If **1051: F00** = Disabled, cut-off regulator is disabled and all its parameters are ignored by the application.

If **1051: F00** = Enabled, cut-off regulator is enabled and its parameters should be properly configured along with the regulation probe **Pb4**.

1052: F01	**Mode**

Cut-off regulator operating mode (heat/cool).

1054: F03	**Start-up time**
	Start-up time during which the analog output bound to the cut-off regulator is forced to maximum level.
1057: F06	**Minimum level**
	Minimum level (percentage) of analog output bound to the cut-off regulator.
1058: F07	**Medium level**
	Medium level (percentage) of analog output bound to the cut-off regulator.
1059: F08	**Maximum level**
	Maximum level (percentage) of analog output bound to the cut-off regulator.
1060: F09	**Setpoint**
	Cut-off regulator setpoint. When setpoint is reached, the analog output bound to the cut-off regulator is forced to minimum level given in parameter **1057: F06**.
1061: F10	**Maximum level differential**
	Differential, relative to the setpoint given in parameter **1060: F09**, at which the cut-off regulator forces the analog output to the maximum level.
1062: F11	**Proportional band**
	Cut-off regulator proportional band.
1063: F12	**Maximum level hysteresis**
	Maximum-Medium level (of the analog output bound to the cut-off regulator) hysteresis width.
1064: F13	**Cut-off hysteresis**
	Cut-off hysteresis width.
1065: F14	**Cut-off differential**
	Differential, relative to the setpoint given in parameter **1060: F09**, at which the cut-off regulator forces the analog output to off (cut-off).
1066: F15	**While defrosting**
	Determines whether cut-off regulator is enabled or disabled during defrost.
	If **1066: F15** = Not active, cut-off regulator is disabled during defrost.
	If1066: F15 = Active, cut-off regulator is enabled during defrost.
1067: F16	**If compressor off**
	Enable/Disabled cut-off regulator when compressor is off.
	If **1067: F16** = Not active, cut-off regulator is disabled when compressor is off.
	If **1067: F16** = Active, cut-off regulator is enabled when compressor is off.
1068: F17	**After defrost exclusion**
	After defrost exclusion time of the cut-off regulator.
1069: F18	**Cut-off bypass time**
	Cut-off bypass time.
1070: F19	**Pre-ventilation**
	Pre-ventilation time.
1071: F20	**If probe KO**
	State of the analog output bound to the cut-off regulator in case of regulation probe error.
	If **1071: F20** = Not active, analog output is forced to off (0%).
	If **1071: F20** = Active, analog output is forced to maximum level (100%).

15.6   Ventilation fans

1072: CON	**Duty cycle time on**
	Ventilation fans duty cycle time on.
1073: COF	**Duty cycle time off**
	Ventilation fans duty cycle time off.

15.7   Alarms

1079: ATT	**Temperature alarm value type**
	Mode of parameters **1081: HAL** and **1082: LAL**, understood as absolute temperature values or as values relative to the setpoint.
	If **1079: ATT** = Absolute, parameters **1081: HAL** and **1082: HAL** give absolute temperature values.
	If **1079: ATT** = Relative, parameters **1081: HAL** and **1082: HAL** give values relative to the setpoint.
1080: AFD	**Temperature differential**
	High/Low temperature alarm differential (with respect to respective thresholds).
1081: HAL	**High temperature threshold**
	High temperature alarm threshold.
	Temperature upper limit (distance from setpoint or absolute value in relation to **1079: ATT**) which, when crossed, triggers an alarm signal.
1082: LAL	**Low temperature threshold**
	Low temperature alarm threshold.
	Temperature lower limit (distance from setpoint or absolute value in relation to **1079: ATT**) which, when crossed, triggers an alarm signal.
1083: PAO	**Power-on exclusion**
	High/Low temperature alarms exclusion time following a power-on.
1084: DAO	**After defrost exclusion**
	High/Low temperature alarms exclusion time after defrost.
1085: OAO	**After door closure exclusion**
	High/Low temperature alarms exclusion time after door closure.
1086: TDO	**Door open delay**
	Time out after alarm signal following digital input deactivation (door open).
1087: TAO	**Temperature alarm delay**
	Delay signaling high/low temperature alarms.
1088: ATH	**Humidity alarms value type**
	Mode of parameters **1089: HHA** and **1090: LHA**, understood as absolute relative humidity values or as values relative to the setpoint.
	If **1088: ATH** = Absolute, parameters **1089: HHA** and **1090: LHA** gives absolute relative humidity values.
	If **1088: ATH** = Relative, parameters **1089: HHA** and **1090: LHA** gives values relative to the setpoint.
1089: HHA	**High humidity threshold**
	High humidity alarm threshold.
	Humidity upper limit (distance from setpoint or absolute value in relation to **1088: ATH**) which, when crossed, triggers an alarm signal.
1090: LHA	**Low humidity threshold**
	Low humidity alarm threshold.
	Humidity lower limit (distance from setpoint or absolute value in relation to **1088: ATH**) which, when crossed, triggers an

alarm signal.

1091: ADH	**Relative humidity differential**
	High/Low humidity alarm differential (with respect to respective thresholds).
1092: AOH	**Relative humidity alarm delay**
	Delay signaling high/low alarms.
1093: PAH	**Power-on exclusion**
	High/Low humidity alarms exclusion time following a power-on.
1094: OAH	**After door closure exclusion**
	High/Low humidity alarms exclusion time after door closure.
1095: DAT	**On defrost timeout**
	Alarm signaling end of defrost due to timeout.
	If **1095: DAT** = No alarm, no alarm is signaled on defrost timeout.
	If **1095: DAT** = Alarm, alarm is signaled on defrost timeout.
1096: RLO	**Lock on external alarm**
	Regulators locked when external alarm is active:
	If **1096: RLO** = None, external alarm does not block any resource.
	If **1096: RLO** = Comp/Defrost, external alarm blocks compressor and defrost.
	If **1096: RLO** = Comp/Defrost/Fan, external alarm blocks compressor, defrost, and evaporator fans.

15.8 Light and digital inputs

1104: DSD	**Light when door open**
	Enables light relay from door switch.
	If **1104: DSD** = Off, opening the door does not turn on the light.
	If **1104: DSD** = On, opening the door turns on the light (when off).
1105: DLT	**Light off delay**
	Delay switching off relay configured as light after door is closed.
	Valid if **1104: DSD** is set to switch on light when door opens.
1106: OFL	**Light off from key**
	Disable light relay from key, even if light off delay **1105: DLT** is active.
1115: PEN	**Pressure switch limit**
	Number of pressure switch events allowed.
1116: PEI	**Pressure switch time**
	Pressure switch event count time interval.

15.9 Display

1122: PA1	**User password**
	Password to access user level parameters (USR level)/the User Menu.
1123: PA2	**Installer password**
	Password to access installer level parameters (INS level)/the Installer Menu.

15.10 Configuration

1154: H05	**Relative humidity regulation**

	If **1154: H05** = Disabled, relative humidity regulation disabled.
	If **1154: H05** = Neutral zone, relative humidity regulation enabled in neutral zone (both humidification and dehumidification).
	If **1154: H05** = Humidification only, relative humidity regulation enabled in humidification only.
	If **1154: H05** = Dehumidification only, relative humidity regulation enabled in dehumidification only.
1156: H07	**Thermoregulation**
	If **1156: H07** = Disabled, thermoregulation disabled.
	If **1156: H07** = Neutral zone, thermoregulation enabled in neutral zone (both heating and cooling).
	If **1156: H07** = Heating only, thermoregulation enabled in heating only.
	If **1156: H07** = Cooling only, thermoregulation enabled in cooling only.
	If **1156: H07** = From digital input, thermoregulation enabled with heat/cool mode selection from digital input.
1158: H09	**Dehumidification type**
	If **1158: H09** = Relay only, dehumidification with dedicated relay.
	If **1158: H09** = Relay and compressor, dehumidification with dedicated relay and compressor.
	If **1158: H09** = No relay, dehumidification with compressor and heating device.
1159: H11	**Digital input 1**
	Digital input 1 configuration.
	See digital input configuration table.
1160: H12	**Digital input 2**
	Digital input 2 configuration.
	See digital input configuration table.
H22	**Digital output 2**
	Digital output 2 configuration.
	See digital output configuration table.
1168: H26	**Digital output 6**
	Digital output 6 configuration.
	See digital output configuration table.
1169: H27	**Digital output 7**
	Digital output 7 configuration.
	See digital output configuration table.
1180: H41	**Probe 1**
	Probe **Pb1** (cell temperature) configuration.
	See analog input configuration table.
1181: H42	**Probe 2**
	Probe **Pb2** (evaporator temperature) configuration.
	See analog input configuration table.
1182: H43	**Probe 3**
	Probe **Pb3** (cell humidity) configuration.
	See analog input configuration table.
1183: H44	**Probe 4**
	Probe **Pb4** (cut-off regulator feedback) configuration.
	See analog input configuration table.

15.11 Programming reference

The following tables report a summary description of the whole set of application parameters discussed in preceding paragraphs, along with information about the range of allowed values, default value, and unit of measurement. Moreover, necessary information to read and write them by means of a fieldbus communication protocol is also recorded.

15.11.1 Parameter menu

The following table indicates the visibility of the application parameters, grouped by folders/menus, depending on access rights granted (user or installer).

Folder	Menu name shown on the display	User menu		Installer menu	
		● = Visible N.A. = Not available	Number of parameters	● = Visible N.A. = Not available	Number of parameters
Compressor	Compressor	●	5/11	●	11/11
Humidity	Humidity	●	2/5	●	5/5
Defrost	Defrost	●	4/7	●	7/7
Evaporator fans	Evaporator fan	●	7/8	●	8/8
Analog output	Analog output	N.A.	0/18	●	18/18
Ventilation fans	Ventilation fan	N.A.	0/2	●	2/2
Alarms	Alarms	N.A.	0/18	●	18/18
Light and digital inputs	Light & D.I.s	N.A.	0/5	●	5/5
Display	Display	●	1/2	●	2/2
Configuration	Configuration	N.A.	0/12	●	12/12

15.11.2 Parameter table

The table below lists all application configuration parameters stored in the device's permanent memory, and their visibilities.

Column meaning:

Column	Meaning
Menu	Menu containing the parameter
Access rights	Required access rights to view/edit parameter: <table><tr><th>Abbreviation</th><th>Required access rights</th></tr><tr><td>-</td><td>None: parameter is available in non-protected menus</td></tr><tr><td>USR/INS</td><td>Parameter is available both in the user menu and in the installer menu</td></tr><tr><td>INS</td><td>Parameter is only available in the installer menu</td></tr></table>
ID	Parameter unique identifier (ID), as it is displayed in the application menu
Label	Parameter label, as it is displayed in the application menu
Address	**Only when accessing the parameter through fieldbus communication protocols (with software tools not included in Eliwell FREE Studio).** Parameter address for access through communication protocol (either Modbus or CANopen).
Description	Parameter description.
Values	Parameter data type: that determines the range of the allowed values for the parameter (to be further refined by the limits shown in Min and Max columns) and the need to apply a conversion, **only when accessing the parameter through fieldbus communication protocols (with software tools not included in Eliwell FREE Studio)**, because the value is signed number.

Column	Meaning
	For example, in case you access to a 16-bit integer parameter by means of a communication protocol, you have to apply the following conversion: • if the value read is between 0 and 32767, the result is equal to the value read (zero and positive values); • if the value read is between 32.768 and 65.535, the result is the value read - 65.536 (negative values).
Min	Minimum value you can assign to the parameter
Max	Maximum value you can assign to the parameter
Default	Default parameter value (set by FREE Studio Device when downloading the application to the FREE Evolution programmable controller).
U.M.	Unit of measurement.
EXP	**Only when accessing the parameter through fieldbus communication protocols (with software tools not included in Eliwell FREE Studio).** If EXP = -1, the value read by means of a fieldbus communication protocol has to be divide by 10 (value/10) in order to convert it to the scale in which Min/Max/Default values are given in the table, according to the U.M. column. Example: parameters HSE = 50.0. Column EXP = -1: • value shown on the display/read by FREE Studio Device is 50.0; • value read by means of a fieldbus communication protocol is 500 → 500/10 = 50.0.

Menu	Access rights	ID	Label	Address	Description	Values	Min	Max	Default	U.M.	EXP
Setpoint	-	1001	SET1	16384	Temperature setpoint 1	Signed 16-bit	1004: LSE	1003: HSE	0,0	°C	-1
Setpoint	-		SET2	16385	Temperature setpoint 2	Signed 16-bit	1004: LSE	1003: HSE	0,0	°C	-1
Compressor	USR/INS	1002	DIF	16386	Compressor regulation differential	Signed 16-bit	0,0	30,0	2,0	°C	-1
Compressor	INS	1003	HSE	16387	Temperature setpoint maximum value	Signed 16-bit	1004: LSE	110,0	50,0	°C	-1
Compressor	INS	1004	LSE	16388	Temperature setpoint minimum value	Signed 16-bit	-50,0	1003: HSE	-50,0	°C	-1
Compressor	INS	1005	OSP	16389	Economy setpoint	Signed 16-bit	-30,0	30,0	0,0	°C	-1
Compressor	INS	1006	HC	16390	Compressor operating mode	(0) = Heating; (1) = Cooling			1		
Compressor	INS	1009	ONT	16393	Compressor duty cycle ON time, in case of probe error	Unsigned 16-bit	0	255	10	min	
Compressor	INS	1010	OFT	16394	Compressor duty cycle OFF time, in case of probe error	Unsigned 16-bit	0	255	10	min	
Compressor	USR/INS	1011	DON	16395	Compressor on-start delay	Unsigned 16-bit	0	1000	10	s	
Compressor	USR/INS	1012	DOF	16396	Compressor stop-start safety time	Unsigned 16-bit	0	1000	0	s	
Compressor	USR/INS	1013	DBI	16397	Compressor start-start safety time	Unsigned 16-bit	0	255	2	min	
Compressor	USR/INS	1014	ODO	16398	Power-on delay activation relay	Unsigned 16-bit	0	255	0	min	
Setpoint	-	1019	SRH	16403	Relative humidity setpoint	Signed 16-bit	1023: LSH	1022: HSH	50,0	%R.H.	-1
Humidity	USR/INS	1021	DBH	16405	Relative humidity regulation differential	Signed 16-bit	0,0	50,0	5,0	%R.H.	-1
Humidity	INS	1022	HSH	16406	Relative humidity setpoint maximum value	Signed 16-bit	1023: LSH	100,0	100,0	%R.H.	-1
Humidity	INS	1023	LSH	16407	Relative humidity setpoint minimum value	Signed 16-bit	0,0	1022: HSH	0,0	%R.H.	-1
Humidity	INS	1024	DEH	16408	Relative humidity regulation during defrost	(0) = Not active; (1) = Active			0		
Humidity	USR/INS	1027	DB	16411	Heating regulation differential	Signed 16-bit	0,0	50,0	2,0	°C	-1
Defrost	INS	1028	DTY	16412	Defrost mode	(0) = Electric; (1) = Cycle inversion; (2) = Free			0		
Defrost	USR/INS	1029	DIT	16413	Interval time between two defrost cycles	Signed 16-bit	0	255	6	h	
Defrost	INS	1032	DCT	16416	Interval time counting type	(0) = Compressor up-time; (1) = Unit up-time; (2) = On compressor stop; (3) = Real time clock			3		
Defrost	INS	1033	DOH	16417	Delay after power-on for the beginning of the first defrost cycle	Unsigned 16-bit	0	59	0	min	
Defrost	USR/INS	1034	DST	16418	Defrost stop temperature	Signed 16-bit	-302,0	1472,0	6,0	°C	-1

Menu	Access rights	ID	Label	Address	Description	Values	Min	Max	Default	U.M.	EXP
Defrost	USR/INS	1036	DPO	16420	Determines if a defrost cycle has to run when the application is switched on	(0) = Not required; (1) = Required			0		
Evaporator fan	USR/INS	1040	FST	16424	Fan stop temperature	Signed 16-bit	-302,0	1472,0	6,0	°C	-1
Evaporator fan	USR/INS	1042	FAD	16426	Fan activation differential	Signed 16-bit	1,0	50,0	1,0	°C	-1
Evaporator fan	USR/INS	1043	FDT	16427	Fan activation delay after a defrosting cycle	Unsigned 16-bit	0	255	0	min	
Evaporator fan	USR/INS	1044	DT	16428	Drainage time	Unsigned 16-bit	0	255	0	min	
Evaporator fan	USR/INS	1045	DFD	16429	Allows exclusion of the evaporator fans to be selected or not selected during defrosting	(0) = Not active; (1) = Active			1		
Evaporator fan	USR/INS	1046	FCO	16430	Selects or not fan deactivation at compressor OFF	(0) = Off; (1) = Thermostat controlled; (2) = Duty cycle			1		
Evaporator fan	USR/INS	1047	FOD	16431	Selects fan deactivation when the door is opened and fan restart when the door is shut (if they were running)	(0) = Not active; (1) = Active			1		
Evaporator fan	INS	1048	FDC	16432	Fan switch off delay after compressor stop, in minutes	Unsigned 8-bit	0	99	0	min	
Analog output	INS	1051	F00	16435	Enable/Disable cut-off regulator	(0) = Disable; (1) = Enable			0		
Analog output	INS	1052	F01	16436	Cut-off regulator operating mode (heat/cool)	(0) = Heating; (1) = Cooling			1		
Analog output	INS	1054	F03	16438	Start-up time during which the analog output bound to the cut-off regulator is forced to maximum level	Unsigned 16-bit	0	60	10	s	
Analog output	INS	1057	F06	16441	Minimum level (percentage) of analog output bound to the cut-off regulator	Signed 16-bit	0	100	30	%	
Analog output	INS	1058	F07	16442	Medium level (percentage) of analog output bound to the cut-off regulator	Signed 16-bit	0	100	95	%	
Analog output	INS	1059	F08	16443	Maximum level (percentage) of analog output bound to the cut-off regulator	Signed 16-bit	0	100	100	%	
Analog output	INS	1060	F09	16444	Cut-off regulator setpoint	Signed 16-bit	-50,0	99,9	30,0		-1
Analog output	INS	1061	F10	16445	Maximum level differential	Signed 16-bit	0,0	99,9	10,0		-1
Analog output	INS	1062	F11	16446	Cut-off regulator proportional band	Signed 16-bit	0,0	25,5	7,0		-1

Menu	Access rights	ID	Label	Address	Description	Values	Min	Max	Default	U.M.	EXP
Analog output	INS	1063	F12	16447	Maximum level hysteresis	Signed 16-bit	0,0	25,5	2,0		-1
Analog output	INS	1064	F13	16448	Cut-off hysteresis width	Signed 16-bit	0,0	25,5	2,0		-1
Analog output	INS	1065	F14	16449	Cut-off differential	Signed 16-bit	0,0	25,5	3,0		-1
Analog output	INS	1066	F15	16450	Determines whether cut-off regulator is enabled or disabled during defrost	(0) = Not active; (1) = Active			1		
Analog output	INS	1067	F16	16451	Enable/Disabled cut-off regulator when compressor is off	(0) = Not active; (1) = Active			1		
Analog output	INS	1068	F17	16452	After defrost exclusion time of the cut-off regulator	Unsigned 8-bit	0	59	0	min	
Analog output	INS	1069	F18	16453	Cut-off bypass time	Unsigned 16-bit	0	255	0	s	
Analog output	INS	1070	F19	16454	Pre-ventilation	Unsigned 16-bit	0	255	0	s	
Analog output	INS	1071	F20	16455	State of the analog output bound to the cut-off regulator in case of regulation probe error	(0) = Not active; (1) = Active			1		
Ventilation fan	INS	1072	CON	16456	Ventilation fans duty cycle time on	Unsigned 16-bit	0	255	1	min	
Ventilation fan	INS	1073	COF	16457	Ventilation fans duty cycle time off	Unsigned 16-bit	0	255	0	min	
Alarms	INS	1079	ATT	16463	Temperature alarm value type	(0) = Absolute; (1) = Relative			1		
Alarms	INS	1080	AFD	16464	Temperature differential	Signed 16-bit	1,0	50,0	1,0	°C	-1
Alarms	INS	1081	HAL	16465	High temperature alarm threshold	Signed 16-bit	1082: LAL		50,0	°C	-1
Alarms	INS	1082	LAL	16466	Low temperature alarm threshold	Signed 16-bit		1081: HAL	-50,0	°C	-1
Alarms	INS	1083	PAO	16467	High/Low temperature alarms exclusion time following a power-on	Unsigned 16-bit	0	10	3	h	
Alarms	INS	1084	DAO	16468	High/Low temperature alarms exclusion time after defrost	Unsigned 16-bit	0	999	60	min	
Alarms	INS	1085	OAO	16469	High/Low temperature alarms exclusion time after door closure	Unsigned 16-bit	0	10	1	h	
Alarms	INS	1086	TDO	16470	Time out after alarm signal following digital input deactivation (door open)	Unsigned 16-bit	0	255	10	min	
Alarms	INS	1087	TAO	16471	Delay signaling high/low temperature alarms	Unsigned 16-bit	0	255	0	min	

Menu	Access rights	ID	Label	Address	Description	Values	Min	Max	Default	U.M.	EXP
Alarms	INS	1088	ATH	16472	Relative humidity alarm value type	(0) = Absolute; (1) = Relative			1		
Alarms	INS	1089	HHA	16473	High humidity alarm threshold	Signed 16-bit	_1090_LHA		50,0	%R.H.	-1
Alarms	INS	1090	LHA	16474	Low humidity alarm threshold	Signed 16-bit		_1089_HHA	-50,0	%R.H.	-1
Alarms	INS	1091	ADH	16475	Relative humidity differential	Signed 16-bit	1,0	50,0	2,0	%R.H.	-1
Alarms	INS	1092	AOH	16476	Relative humidity alarm delay	Unsigned 16-bit	0	255	0	min	
Alarms	INS	1093	PAO	16477	High/Low humidity alarms exclusion time following a power-on	Unsigned 16-bit	0	10	3	h	
Alarms	INS	1094	OAH	16478	High/Low humidity alarms exclusion time after door closure	Unsigned 16-bit	0	10	1	h	
Alarms	INS	1095	DAT	16479	Alarm signaling end of defrost due to timeout	(0) = No alarm; (1) = Alarm			0		
Alarms	INS	1096	RLO	16480	Regulators locked when external alarm is active	(0) = None; (1) = Compressor and defrost; (2) = Compressor, defrost, and fans			0		
Light & D.I.s	INS	1104	DSD	16488	Enables light relay from door switch	Boolean			1		
Light & D.I.s	INS	1105	DLT	16489	Delay switching off relay configured as light after door is closed	Unsigned 8-bit	0	31	0	min	
Light & D.I.s	INS	1106	OFL	16490	Disable light relay from key, even if light off delay 1105: DLT is active	Boolean			1		
Light & D.I.s	INS	1115	PEN	16499	Number of pressure switch events allowed	Unsigned 16-bit	0	15	15		
Light & D.I.s	INS	1116	PEI	16500	Pressure switch event count time interval	Unsigned 16-bit	1	99	99	min	
Display	USR/INS	1122	PA1	16506	User password	String			***10		
Display	INS	1123	PA2	16509	Installer password	String			***20		
Configuration	INS	1154	H05	16542	Relative humidity regulation mode	(0) = Disabled; (1) = Neutral zone; (2) = Humidification only; (3) = Dehumidification only			1		
Configuration	INS	1156	H07	16544	Thermoregulation mode	(0) = Disabled; (1) = Neutral zone; (2) = Heating only; (3) = Cooling only; (4) = Heating and cooling from DI			1		
Configuration	INS	1158	H09	16546	Dehumidification mode	(0) = Relay only; (1) = Relay and compressor; (2) = No relay (heating and cooling)			0		
Configuration	INS	1159	H11	16547	Digital input 1 configuration	(0) = Disabled; (1) = NO, Defrost request; (-1) = NC, Defrost request; (2) = NO, Economy; (-2) = NC, Economy; (4) = NO, Door switch; (-4) = NC, Door switch; (5) = NO,			4		

Menu	Access rights	ID	Label	Address	Description	Values	Min	Max	Default	U.M.	EXP
						External alarm; (-5) = NC, External alarm; (7) = NO, Stand-by; (-7) = NC, Stand-by; (11) = NO, Pressure switch; (-11) = NC, Pressure switch; (14) = NO, Light; (-14) = NC, Light; (15) = NO, Ventilation; (-15) = NC, Ventilation; (18) = NO, Panic; (-18) = NC, Panic; (20) = NO, Heat/Cool; (-20) = NC, Heat/Cool; (21) = NO, AUTO mode request; (-21) = NC, AUTO mode request					
Configuration	INS	1160	H12	16548	Digital input 2 configuration	(0) = Disabled; (1) = NO, Defrost request; (-1) = NC, Defrost request; (2) = NO, Economy; (-2) = NC, Economy; (4) = NO, Door switch; (-4) = NC, Door switch; (5) = NO, External alarm; (-5) = NC, External alarm; (7) = NO, Stand-by; (-7) = NC, Stand-by; (11) = NO, Pressure switch; (-11) = NC, Pressure switch; (14) = NO, Light; (-14) = NC, Light; (15) = NO, Ventilation; (-15) = NC, Ventilation; (18) = NO, Panic; (-18) = NC, Panic; (20) = NO, Heat/Cool; (-20) = NC, Heat/Cool; (21) = NO, AUTO mode request; (-21) = NC, AUTO mode request			5		
Configuration	INS	-	H22	16556	Digital output 2 configuration	(1) = Dehumidifier; (2) = Electric defrost			1		
Configuration	INS	1168	H26	16557	Digital output 6 configuration	(0) = Disabled; (7) = Light; (11) = Ventilation fan			7		
Configuration	INS	1169	H27	16558	Digital output 7 configuration	(0) = Disabled; (7) = Light; (11) = Ventilation fan			0		
Configuration	INS	1180	H41	16569	Probe 1 configuration	(0) = Disabled; (1) = Analog input 1; (2) = Analog input 2; (3) = Analog input 3; (4) = Analog input 4; (5) = Analog input 5; (6) = Analog input 6			1		
Configuration	INS	1181	H42	16570	Probe 2 configuration	(0) = Disabled; (1) = Analog input 1; (2) = Analog input 2; (3) = Analog input 3; (4) = Analog input 4; (5) = Analog input 5; (6) = Analog input 6			2		
Configuration	INS	1182	H43	16571	Probe 3 configuration	(0) = Disabled; (1) = Analog input 1; (2) = Analog input 2;			3		

Menu	Access rights	ID	Label	Address	Description	Values	Min	Max	Default	U.M.	EXP
						(3) = Analog input 3; (4) = Analog input 4; (5) = Analog input 5; (6) = Analog input 6					
Configuration	INS	1183	H44	16572	Probe 4 configuration	(0) = Disabled; (1) = Analog input 1; (2) = Analog input 2; (3) = Analog input 3; (4) = Analog input 4; (5) = Analog input 5; (6) = Analog input 6			4		
Defrost	USR/INS	1189	DET	16578	Defrost timeout	Unsigned 16-bit	1	255	30	min	
Defrost times > Working days	-	-	DE1	16600	Defrost starting time no. 1 on working days	Signed 16-bit	0	1440	1440		
Defrost times > Working days	-	-	DE2	16601	Defrost starting time no. 2 on working days	Signed 16-bit	0	1440	1440		
Defrost times > Working days	-	-	DE3	16602	Defrost starting time no. 3 on working days	Signed 16-bit	0	1440	1440		
Defrost times > Working days	-	-	DE4	16603	Defrost starting time no. 4 on working days	Signed 16-bit	0	1440	1440		
Defrost times > Working days	-	-	DE5	16604	Defrost starting time no. 5 on working days	Signed 16-bit	0	1440	1440		
Defrost times > Working days	-	-	DE6	16605	Defrost starting time no. 6 on working days	Signed 16-bit	0	1440	1440		
Defrost times > Working days	-	-	DE7	16606	Defrost starting time no. 7 on working days	Signed 16-bit	0	1440	1440		
Defrost times > Working days	-	-	DE8	16607	Defrost starting time no. 8 on working days	Signed 16-bit	0	1440	1440		
Defrost times > Weekend	-	-	F1	16608	Defrost starting time no. 1 during weekend	Signed 16-bit	0	1440	1440		
Defrost times > Weekend	-	-	F2	16609	Defrost starting time no. 2 during weekend	Signed 16-bit	0	1440	1440		
Defrost times > Weekend	-	-	F3	16610	Defrost starting time no. 3 during weekend	Signed 16-bit	0	1440	1440		

Menu	Access rights	ID	Label	Address	Description	Values	Min	Max	Default	U.M.	EXP
Defrost times > Weekend	-	-	F4	16611	Defrost starting time no. 4 during weekend	Signed 16-bit	0	1440	1440		
Defrost times > Weekend	-	-	F5	16612	Defrost starting time no. 5 during weekend	Signed 16-bit	0	1440	1440		
Defrost times > Weekend	-	-	F6	16613	Defrost starting time no. 6 during weekend	Signed 16-bit	0	1440	1440		
Defrost times > Weekend	-	-	F7	16614	Defrost starting time no. 7 during weekend	Signed 16-bit	0	1440	1440		
Defrost times > Weekend	-	-	F8	16615	Defrost starting time no. 8 during weekend	Signed 16-bit	0	1440	1440		
Thermal profiles > Step 1	-	-	1P0	16616	Step activation delay (step 1)	Unsigned 16-bit	0	5999	0	min	
Thermal profiles > Step 1	-	-	1P1	16617	Step duration (step 1)	Unsigned 16-bit	0	5999	60	min	
Thermal profiles > Step 1	-	-	1P2	16618	Relative humidity regulation mode (step 1)	(0) = Disabled; (1) = Neutral zone; (2) = Humidification only; (3) = Dehumidification only			1		
Thermal profiles > Step 1	-	-	1P3	16619	Thermoregulation mode (step 1)	(0) = Disabled; (1) = Neutral zone; (2) = Heating only; (3) = Cooling only; (4) = Heating and cooling from DI			1		
Thermal profiles > Step 1	-	-	1P4	16620	Relative humidity setpoint (step 1)	Signed 16-bit	_1023_LSH	_1022_HSH	50,0	%R.H.	-1
Thermal profiles > Step 1	-	-	1P5	16621	Temperature 1 setpoint (step 1)	Signed 16-bit	_1004_LSE	_1003_HSE	0,0	°C	-1
Thermal profiles > Step 1	-	-	1P6	16622	Temperature 2 setpoint (step 1)	Signed 16-bit	_1004_LSE	_1003_HSE	0,0	°C	-1
Thermal profiles > Step 1	-	-	1P7	16623	Enables ventilation fans relay (step 1)	Boolean			0		
Thermal profiles > Step 1	-	-	1P8	16624	End step action (step 1)	(1) = End; (2) = Next (continue); (3) = Next (suspend); (4) = Loop; (5) = Go to step; (6) = Everlasting			1		
Thermal profiles > Step 1	-	-	1P9	16625	Jump back target step (step 1)	(0) = STEP 1; (1) = STEP 2; (2) = STEP 3; (3) = STEP 4; (4) = STEP 5; (5) = STEP 6; (6) = STEP 7; (7) = STEP 8			0		
Thermal profiles > Step 2	-	-	2P0	16626	Step activation delay (step 2)	Unsigned 16-bit	0	5999	0	min	

Menu	Access rights	ID	Label	Address	Description	Values	Min	Max	Default	U.M.	EXP
Thermal profiles > Step 2	-	-	2P1	16627	Step duration (step 2)	Unsigned 16-bit	0	5999	60	min	
Thermal profiles > Step 2	-	-	2P2	16628	Relative humidity regulation mode (step 2)	(0) = Disabled; (1) = Neutral zone; (2) = Humidification only; (3) = Dehumidification only			1		
Thermal profiles > Step 2	-	-	2P3	16629	Thermoregulation mode (step 2)	(0) = Disabled; (1) = Neutral zone; (2) = Heating only; (3) = Cooling only; (4) = Heating and cooling from DI			1		
Thermal profiles > Step 2	-	-	2P4	16630	Relative humidity setpoint (step 2)	Signed 16-bit	_1023_LSH	_1022_HSH	50,0	%R.H.	-1
Thermal profiles > Step 2	-	-	2P5	16631	Temperature 1 setpoint (step 2)	Signed 16-bit	_1004_LSE	_1003_HSE	0,0	°C	-1
Thermal profiles > Step 2	-	-	2P6	16632	Temperature 2 setpoint (step 2)	Signed 16-bit	_1004_LSE	_1003_HSE	0,0	°C	-1
Thermal profiles > Step 2	-	-	2P7	16633	Enables ventilation fans relay (step 2)	Boolean			0		
Thermal profiles > Step 2	-	-	2P8	16634	End step action (step 2)	(1) = End; (2) = Next (continue); (3) = Next (suspend); (4) = Loop; (5) = Go to step; (6) = Everlasting			1		
Thermal profiles > Step 2	-	-	2P9	16635	Jump back target step (step 2)	(0) = STEP 1; (1) = STEP 2; (2) = STEP 3; (3) = STEP 4; (4) = STEP 5; (5) = STEP 6; (6) = STEP 7; (7) = STEP 8			0		
Thermal profiles > Step 3	-	-	3P0	16636	Step activation delay (step 3)	Unsigned 16-bit	0	5999	0	min	
Thermal profiles > Step 3	-	-	3P1	16637	Step duration (step 3)	Unsigned 16-bit	0	5999	60	min	
Thermal profiles > Step 3	-	-	3P2	16638	Relative humidity regulation mode (step 3)	(0) = Disabled; (1) = Neutral zone; (2) = Humidification only; (3) = Dehumidification only			1		
Thermal profiles > Step 3	-	-	3P3	16639	Thermoregulation mode (step 3)	(0) = Disabled; (1) = Neutral zone; (2) = Heating only; (3) = Cooling only; (4) = Heating and cooling from DI			1		
Thermal profiles > Step 3	-	-	3P4	16640	Relative humidity setpoint (step 3)	Signed 16-bit	_1023_LSH	_1022_HSH	50,0	%R.H.	-1
Thermal profiles > Step 3	-	-	3P5	16641	Temperature 1 setpoint (step 3)	Signed 16-bit	_1004_LSE	_1003_HSE	0,0	°C	-1
Thermal profiles > Step 3	-	-	3P6	16642	Temperature 2 setpoint (step 3)	Signed 16-bit	_1004_LSE	_1003_HSE	0,0	°C	-1

Menu	Access rights	ID	Label	Address	Description	Values	Min	Max	Default	U.M.	EXP
Thermal profiles > Step 3	-	-	3P7	16643	Enables ventilation fans relay (step 3)	Boolean			0		
Thermal profiles > Step 3	-	-	3P8	16644	End step action (step 3)	(1) = End; (2) = Next (continue); (3) = Next (suspend); (4) = Loop; (5) = Go to step; (6) = Everlasting			1		
Thermal profiles > Step 3	-	-	3P9	16645	Jump back target step (step 3)	(0) = STEP 1; (1) = STEP 2; (2) = STEP 3; (3) = STEP 4; (4) = STEP 5; (5) = STEP 6; (6) = STEP 7; (7) = STEP 8			0		
Thermal profiles > Step 4	-	-	4P0	16646	Step activation delay (step 4)	Unsigned 16-bit	0	5999	0	min	
Thermal profiles > Step 4	-	-	4P1	16647	Step duration (step 4)	Unsigned 16-bit	0	5999	60	min	
Thermal profiles > Step 4	-	-	4P2	16648	Relative humidity regulation mode (step 4)	(0) = Disabled; (1) = Neutral zone; (2) = Humidification only; (3) = Dehumidification only			1		
Thermal profiles > Step 4	-	-	4P3	16649	Thermoregulation mode (step 4)	(0) = Disabled; (1) = Neutral zone; (2) = Heating only; (3) = Cooling only; (4) = Heating and cooling from DI			1		
Thermal profiles > Step 4	-	-	4P4	16650	Relative humidity setpoint (step 4)	Signed 16-bit	_1023_LSH	_1022_HSH	50,0	%R.H.	-1
Thermal profiles > Step 4	-	-	4P5	16651	Temperature 1 setpoint (step 4)	Signed 16-bit	_1004_LSE	_1003_HSE	0,0	°C	-1
Thermal profiles > Step 4	-	-	4P6	16652	Temperature 2 setpoint (step 4)	Signed 16-bit	_1004_LSE	_1003_HSE	0,0	°C	-1
Thermal profiles > Step 4	-	-	4P7	16653	Enables ventilation fans relay (step 4)	Boolean			0		
Thermal profiles > Step 4	-	-	4P8	16654	End step action (step 4)	(1) = End; (2) = Next (continue); (3) = Next (suspend); (4) = Loop; (5) = Go to step; (6) = Everlasting			1		
Thermal profiles > Step 4	-	-	4P9	16655	Jump back target step (step 4)	(0) = STEP 1; (1) = STEP 2; (2) = STEP 3; (3) = STEP 4; (4) = STEP 5; (5) = STEP 6; (6) = STEP 7; (7) = STEP 8			0		
Thermal profiles > Step 5	-	-	5P0	16656	Step activation delay (step 5)	Unsigned 16-bit	0	5999	0	min	
Thermal profiles > Step 5	-	-	5P1	16657	Step duration (step 5)	Unsigned 16-bit	0	5999	60	min	
Thermal profiles > Step 5	-	-	5P2	16658	Relative humidity regulation mode (step 5)	(0) = Disabled; (1) = Neutral zone; (2) = Humidification only; (3) = Dehumidification only			1		

Menu	Access rights	ID	Label	Address	Description	Values	Min	Max	Default	U.M.	EXP
Thermal profiles > Step 5	-	-	5P3	16659	Thermoregulation mode (step 5)	(0) = Disabled; (1) = Neutral zone; (2) = Heating only; (3) = Cooling only; (4) = Heating and cooling from DI			1		
Thermal profiles > Step 5	-	-	5P4	16660	Relative humidity setpoint (step 5)	Signed 16-bit	_1023_LSH	_1022_HSH	50,0	%R.H.	-1
Thermal profiles > Step 5	-	-	5P5	16661	Temperature 1 setpoint (step 5)	Signed 16-bit	_1004_LSE	_1003_HSE	0,0	°C	-1
Thermal profiles > Step 5	-	-	5P6	16662	Temperature 2 setpoint (step 5)	Signed 16-bit	_1004_LSE	_1003_HSE	0,0	°C	-1
Thermal profiles > Step 5	-	-	5P7	16663	Enables ventilation fans relay (step 5)	Boolean			0		
Thermal profiles > Step 5	-	-	5P8	16664	End step action (step 5)	(1) = End; (2) = Next (continue); (3) = Next (suspend); (4) = Loop; (5) = Go to step; (6) = Everlasting			1		
Thermal profiles > Step 5	-	-	5P9	16665	Jump back target step (step 5)	(0) = STEP 1; (1) = STEP 2; (2) = STEP 3; (3) = STEP 4; (4) = STEP 5; (5) = STEP 6; (6) = STEP 7; (7) = STEP 8			0		
Thermal profiles > Step 6	-	-	6P0	16666	Step activation delay (step 6)	Unsigned 16-bit	0	5999	0	min	
Thermal profiles > Step 6	-	-	6P1	16667	Step duration (step 6)	Unsigned 16-bit	0	5999	60	min	
Thermal profiles > Step 6	-	-	6P2	16668	Relative humidity regulation mode (step 6)	(0) = Disabled; (1) = Neutral zone; (2) = Humidification only; (3) = Dehumidification only			1		
Thermal profiles > Step 6	-	-	6P3	16669	Thermoregulation mode (step 6)	(0) = Disabled; (1) = Neutral zone; (2) = Heating only; (3) = Cooling only; (4) = Heating and cooling from DI			1		
Thermal profiles > Step 6	-	-	6P4	16670	Relative humidity setpoint (step 6)	Signed 16-bit	_1023_LSH	_1022_HSH	50,0	%R.H.	-1
Thermal profiles > Step 6	-	-	6P5	16671	Temperature 1 setpoint (step 6)	Signed 16-bit	_1004_LSE	_1003_HSE	0,0	°C	-1
Thermal profiles > Step 6	-	-	6P6	16672	Temperature 2 setpoint (step 6)	Signed 16-bit	_1004_LSE	_1003_HSE	0,0	°C	-1
Thermal profiles > Step 6	-	-	6P7	16673	Enables ventilation fans relay (step 6)	Boolean			0		
Thermal profiles > Step 6	-	-	6P8	16674	End step action (step 6)	(1) = End; (2) = Next (continue); (3) = Next (suspend); (4) = Loop; (5) = Go to step; (6) = Everlasting			1		

Menu	Access rights	ID	Label	Address	Description	Values	Min	Max	Default	U.M.	EXP
Thermal profiles > Step 6	-	-	6P9	16675	Jump back target step (step 6)	(0) = STEP 1; (1) = STEP 2; (2) = STEP 3; (3) = STEP 4; (4) = STEP 5; (5) = STEP 6; (6) = STEP 7; (7) = STEP 8			0		
Thermal profiles > Step 7	-	-	7P0	16676	Step activation delay (step 7)	Unsigned 16-bit	0	5999	0	min	
Thermal profiles > Step 7	-	-	7P1	16677	Step duration (step 7)	Unsigned 16-bit	0	5999	60	min	
Thermal profiles > Step 7	-	-	7P2	16678	Relative humidity regulation mode (step 7)	(0) = Disabled; (1) = Neutral zone; (2) = Humidification only; (3) = Dehumidification only			1		
Thermal profiles > Step 7	-	-	7P3	16679	Thermoregulation mode (step 7)	(0) = Disabled; (1) = Neutral zone; (2) = Heating only; (3) = Cooling only; (4) = Heating and cooling from DI			1		
Thermal profiles > Step 7	-	-	7P4	16680	Relative humidity setpoint (step 7)	Signed 16-bit	_1023_LSH	_1022_HSH	50,0	%R.H.	-1
Thermal profiles > Step 7	-	-	7P5	16681	Temperature 1 setpoint (step 7)	Signed 16-bit	_1004_LSE	_1003_HSE	0,0	°C	-1
Thermal profiles > Step 7	-	-	7P6	16682	Temperature 2 setpoint (step 7)	Signed 16-bit	_1004_LSE	_1003_HSE	0,0	°C	-1
Thermal profiles > Step 7	-	-	7P7	16683	Enables ventilation fans relay (step 7)	Boolean			0		
Thermal profiles > Step 7	-	-	7P8	16684	End step action (step 7)	(1) = End; (2) = Next (continue); (3) = Next (suspend); (4) = Loop; (5) = Go to step; (6) = Everlasting			1		
Thermal profiles > Step 7	-	-	7P9	16685	Jump back target step (step 7)	(0) = STEP 1; (1) = STEP 2; (2) = STEP 3; (3) = STEP 4; (4) = STEP 5; (5) = STEP 6; (6) = STEP 7; (7) = STEP 8			0		
Thermal profiles > Step 8	-	-	8P0	16686	Step activation delay (step 8)	Unsigned 16-bit	0	5999	0	min	
Thermal profiles > Step 8	-	-	8P1	16687	Step duration (step 8)	Unsigned 16-bit	0	5999	60	min	
Thermal profiles > Step 8	-	-	8P2	16688	Relative humidity regulation mode (step 8)	(0) = Disabled; (1) = Neutral zone; (2) = Humidification only; (3) = Dehumidification only			1		
Thermal profiles > Step 8	-	-	8P3	16689	Thermoregulation mode (step 8)	(0) = Disabled; (1) = Neutral zone; (2) = Heating only; (3) = Cooling only; (4) = Heating and cooling from DI			1		
Thermal profiles > Step 8	-	-	8P4	16690	Relative humidity setpoint (step 8)	Signed 16-bit	_1023_LSH	_1022_HSH	50,0	%R.H.	-1

Menu	Access rights	ID	Label	Address	Description	Values	Min	Max	Default	U.M.	EXP
Thermal profiles > Step 8	-	-	8P5	16691	Temperature 1 setpoint (step 8)	Signed 16-bit	_1004_LSE	_1003_HSE	0,0	°C	-1
Thermal profiles > Step 8	-	-	8P6	16692	Temperature 2 setpoint (step 8)	Signed 16-bit	_1004_LSE	_1003_HSE	0,0	°C	-1
Thermal profiles > Step 8	-	-	8P7	16693	Enables ventilation fans relay (step 8)	Boolean			0		
Thermal profiles > Step 8	-	-	8P8	16694	End step action (step 8)	(1) = End; (2) = Next (continue); (3) = Next (suspend); (4) = Loop; (5) = Go to step; (6) = Everlasting			1		
Thermal profiles > Step 8	-	-	8P9	16695	Jump back target step (step 8)	(0) = STEP 1; (1) = STEP 2; (2) = STEP 3; (3) = STEP 4; (4) = STEP 5; (5) = STEP 6; (6) = STEP 7; (7) = STEP 8			0		

ALPHABETICAL INDEX